WASTE SORT PROJECT
ANGUILLA LANDFILL
ST.CROIX-U.S.V.I
APRIL 12-18,2000

FINAL WASTE SORT REPORT

Part 1-Field Report by Austin Moorehead

Part 2-Technical Report by Deniz Ergun Seker

PROJECT DIRECTOR
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The Final Waste Sort Report document provides the reader with the most recent information available on the waste characteristics present at the Anguilla Landfill on St. Croix, U.S.V.I. The Final Waste Sort Report encapsulates all the pertinent data on the various types of waste. Individual items were sorted and placed into specific datasets (e.g No. 1, No. 2, No. 3 Plastics). These sets were aggregated into greater sets such as plastics, paper and the like. Numerous graphs and charts represent the data in an easily readable format.

The Waste Sort Project was an out growth of the Antilitter and Beautification Commission's desire to develop locally based sustainable recycling programs. Given the small amount of waste that is generated in St. Croix the Commission considered it important to have the most up to date and accurate information and projections. The need for this type of information cannot be understood in recycling. However, the cost of this type of information has heretofore been cost prohibitive. Realizing this, but armed with knowledge of the local capacity to perform such an undertaking the Commission sought out high quality local talent. Through the work of two local individuals, Ms. Deniz Ergun Seker and Mr. Austin Moorehead, the survey was designed and implemented. Several young Virgin Islanders were selected to participate in the actual sorting of materials at the landfill. As expected relying on local talent made the task affordable and demonstrated that we need not always look for technical services, a very important factor in sustainability.

This document has the distinction of being both technically rigorous and yet quit readable. The intention being, that this type of document should be used by decision makers in both the private and public sectors. Utilization of the information found within will provide solid background data for the preparation of plans to divert various streams of waste. Burgeoning recycling based businesses shall also find the data valuable as they seek hard data on raw materials for salvage, export or remanufacturing. Additionally, as the virgin islands moves towards the selection of a Solid Waste Management vendor for our current and future needs, this type of information must be incorporated in the upfront thinking on the facilities that are needed.

Found within are some projections that warrant consideration as they could lead to some great cost savings for the Virgin Islands government and some wonderful opportunities for the private sector. Of note is the considerable amount of compostable organic, which if diverted could reduce the annual input by over one third. We hope that the Public and Private sectors take note of this document and use it a s a tool for gaining better insight into the "resource stream" that we typically call a waste stream.

Again, I am happy that the Antilitter and Beautification Commission could participate in this waste sort and provide the people of the Virgin Islands with sound technical information.

John Green
Executive Director
Antilitter and Beautification Commission

EXECUTIVE SUMMARY

" One thing you can't recycle is wasted time"
Anonymous

The Waste Sort Project was an out growth of the Antilitter and Beautification Commission's desire to assist in the development of locally based, sustainable, recycling programs. Given the small amount of waste that is generated in St. Croix, the Commission considered it important to have the most up to date and accurate information and projections. The waste sort was conducted by the Commission, from April 8 through April 12, 2000 in the Anguilla Landfill- St. Croix, U.S. Virgin Islands. The primary goal of the waste sort was to gain a thorough knowledge of the landfill characteristics in order to assist in the design and implementation of efficient waste reduction/management strategies. Thus, the main objectives of the project were to collect new data on the landfill waste characteristics, to evaluate whether the existing data on the landfill characteristics are still valid, and finally to provide this information to the decision makers and the entrepreneurs in the Territory.

Based on the analysis of the data obtained during the Waste Sort Project, several points are worthy of emphasis. Consideration of each of the following will be necessary to address the current crisis and to develop sustainable solutions for the future:

- We generate approximately between 110,000 and 130,000 tons of solid waste annually in St. Croix.
- The figure of waste generated per person per day is 12 pounds. In St. Croix nearly two tons of waste, per resident is landfilled during each year. This is twice the average of US households.
- The compostable organic waste is the major waste category in the Anguilla Landfill at 35%. This category consists of yard waste, wood waste and food waste. Therefore, the greatest impact in reducing the amount destined for the landfill would be achieved by broadening and expanding local composting initiatives to include a comprehensive island-wide system for the composting of source separated organic materials.
- Metals/ Appliances/ Junk Cars represent another waste category, which offers recycling business opportunities to local entrepreneurs. The recent junk car removal project and construction activities in the Territory are expected to increase the impact of this category in the general waste stream. (For metals up to nearly 20 % and for appliances up to 5 %, which represent ¼ of the waste stream.) However from the previous records, it is known that the share of this category could fluctuate significantly from year to year. (up to 6 %) Profitable business opportunities may be available in the areas of reuse and recycling of the various items contained in this category.

- Construction and Demolition waste represents the other highly recyclable waste category, with almost 10% of the general waste stream.
- Paper waste, which also covers 10 % of the general waste stream, could be one of the first target materials for source reduction activities. Actions ranging from the more complex, like developing legislation to require reduced packaging materials on imports, to simple in office strategies such as using less office paper by using both sides of the paper, could assist in the reduction of a large portion of the waste stream.
- Plastic and glass waste combined represent 10% of the general waste stream; not a great amount when compared to the other waste types. But their wide use in our daily life and their capability of recycling could offer an alternative as a small scale recycling business.
- Recycling in general is an option that is increasingly taking hold in industrialized economies. The current and projected amounts of various waste types coupled with appropriate policy measures could insure moderate economic activity or opportunities for such. Recycling needs to be investigated in terms of its economic benefit for the Territory and appropriate measures taken to insure sustainability of the ventures.
- Landfills are and will continue to play a role in the management of solid waste in the Territory. Additionally, due to the fact that in the foreseeable future waste will continue to be a by-product of our society, accurate record keeping is important. Assessment of trends, the design of new programs and even future rates charged for disposal must be based on reliable information. As such it is very important to improve the conditions in the landfill's data gathering mechanisms. The provision of computerized scales, computerization of record-keeping and regular scale calibration will provide the Territory with readily available and accurate information. A disposal fee could positively affect the conditions in the landfill operations by providing the necessary financial support.
- Waste audits are one of the significant instruments to create a base for a successful solid waste management program. Therefore, waste sort projects should be continued and spread throughout the U.S. Virgin Islands. Finally feasibility studies for future businesses should be done in accordance with the results of these activities.

The problems caused by landfills have become a source of public concern in recent years. As we have become more aware of the potential threat to health and the environment from toxic substances, we also have become more concerned about the generation and management of solid waste.

The Government of the Virgin Islands (GVI) search for solutions to the Territories solid waste crisis has concurrently intensified over the last several years. In this regard, the GVI issued a Request For Proposals for the design, construction and operation of a comprehensive integrated solid waste management facility in FY-2000. The results of the Waste Sort Project strongly support the need for an integrated solid waste

management approach.

This strategic approach involves a mix of several waste management techniques:

- Decreasing the amount and /or toxicity of waste that must be disposed of by producing less waste to begin with (source reduction),
- Diverting selected materials through programming and market development (e.g. backyard and/or municipal composting, or waste exchanges),
- Increasing recycling of materials such as steel, glass, plastic, thus recovering these materials rather than discarding them, and,
- Providing safer disposal capacity by improving the design and management of incinerators and landfills.

Source reduction, diversion and recycling can keep a great deal of waste out of landfills, never the less, a landfill will still be necessary even if only at a minimal scale. Challenges remain in the development of the programming to insure that the products that can be economically reduced, diverted and/or recycled will and, in fact, are. The development and utilization of an integrated solid waste management plan will insure that the "trash" is seen as a commodity. Of course an integrated waste management system entails a careful analysis of what is in the waste stream and how to recover the various materials at the point of highest value. With this new definition and sufficient reliable information the Territory may begin to develop the solid waste industry into an integral part of our economic growth. The process of planning and actualization of the plan will require a strong partnership of government, industry and residents.

As the Territory shifts its thinking on solid waste from out-of-sight/out-of-mind to forefront policy issues, it becomes apparent that the mass of waste we discard annually has a multitude of valuable and recoverable materials. The development of policies, strategies and programming, that match the unique characteristics of the waste stream with a mix of activities that will utilize to the highest degree possible these, newly recognized, commodities will serve us all now and far into the future.

John M. Green
Executive Director
Antilitter and Beautification Commission

FINAL WASTE SORT REPORT

Field Report
by

Austin Moorehead

ANGUILLA WASTE SORT PROJECT REPORT

Introduction

The Anguilla Waste Sort Project (AWSP) was sponsored and implemented by the Anti-Litter and Beautification Commission (ALBC) of the Department of Public Works (DPW). This project was spearheaded by the Executive Director, John Green, who also participated in the planning phase of the project. Executive Director Green should also be commended for recruiting the technical expertise of Deniz Ergun Seker, Agricultural Engineer and Economist, who provided the databases and technical analysis for the project, and Austin Moorehead, the Site Director and Quality Assurance Manager.

One of the major goals of the waste sort project was to collect new environmental information to evaluate whether the existing waste characterization data[1] on the Anguilla Landfill are valid, and if so, further enhance the characterization of that waste stream by providing a greater level of detail on the components of the Anguilla Landfill waste stream. Once completed this information could then supplement the existing recycling feasibility assessment database and maximize our recycling opportunities, as well as inform the implementation of comprehensive integrated solid waste management solutions. More specifically, the survey will estimate the relative percentage each of the following Anguilla Landfill waste stream categories; Paper, Plastics, Glass, Metal, Compostable Organics and an Other category that includes miscellaneous items or items that do not fall into the first five categories. Further each these categories above was again divided into subcategories[2].

Preparation

The AWSP was conducted at the Anguilla Landfill on St. Croix. The Waste Sort Team (WST) consisted of a Site Director and Assistant, a Senior Sorter and a five member WST. The planning phase of the project was conducted primarily by Deniz Ergun Seker, John Green, and Austin L. Moorehead.

[1]Sort III Report Waste Characterization Analysis by GBB.

[2]See Waste Sort in St. Croix Plan by Deniz Ergun Seker.

This project was conducted with full consideration of the resource limited status of the Government of the Virgin Islands (GVI). As a result it was important to minimize expenditures related to data collection by eliminating unnecessary duplicative or overly precise data. At the same time it was important to the decision maker, Director Green, to collect data of sufficient quality and quantity to support defensible decision making. Both of these goals were accomplished by establishing acceptable decision criteria and a random sampling data collection design based on that decision criteria before the study began. The decision maker decided that a 90 % confidence level with +/- 20% confidence interval would be acceptable decision quality. A simple random sample selection approach was used. Random sampling gives each type of incoming waste truck an equal chance of being selected. This is important because historical data indicates that waste trucks arrive with loads of only tires, metals, yard waste, construction/demolition waste and household waste. Therefore, it is important to insure each member of that population of waste trucks has a fair chance of being chosen. The amount of samples required to satisfy this decision criterion and sample selection method ranges and from 68 -161. This would be achieved by selecting seven trucks a day for five days and extracting two samples per truck.. The number of samples required to have higher decision quality (i.e., confidence level) increases dramatically and as such , the cost of the survey also increases. During the planning phase, the planning team identified all of the issues that must be addressed to insure that the implementation phase would run smoothly. These issues include: members of the WST, decision maker, description of the problem that required collection of new information, decision to be made based on data, information needs, data uses, available resources and relevant deadlines.

Anguilla Waste Sort Test Run

On April 10 and 11, the WST conducted a test or trial run of the project activities. The purpose of the trial was to identify and resolve any obstacles not identified during the planning process. The trial produced some valuable information. The results of the two day trial confirmed that the actual flow of project activities, from truck selection to the final weighing of the waste containers, were achievable within the time available. However, it also revealed that the scale for weighing the individual waste containers when they were filled by the sorters was not functioning properly. Therefore, the WST requested and received support from Archie Corbitt, Chief of the Division of Weights and Measurements in the Department of Consumer and Licensing Affairs (DCLA). Mr. Corbitt subjected the scale to a calibration test at various levels of the operating range which was between 4.8 to 300

pounds. The scale failed the test and therefore, could not be relied upon to record the weight of the waste in each category.

Waste Truck Selection

A random number generator was used to identify numbers that will represent the incoming waste disposal trucks from which waste samples will be extracted. The results of the random number generator exercise produced the following numbers; 17, 32, 49, 57, 65, 73, and 85. Therefore, the first truck to be sampled would be the seventeenth truck that arrived at the Anguilla Landfill (AL) and the second truck to be sampled would be the thirty-second truck and so on. The intervals between the random numbers allowed the waste sort team sufficient time to have the selected trucks directed to main waste area and sorted, in most cases prior to the arrival of the next waste disposal truck to be sampled.

The Assistant to the Site Director was stationed at the scale house where the incoming waste trucks are weighed and then directed to the appropriate waste disposal area. His responsibilities were to record the weight of the truck , direct the truck to the proper landfill waste disposal area, determine and inform the senior sorter on the amount of coning and quartering necessary to collect two approximately two-hundred pound samples. Additionally, due to the intense work on the first three days, the soil became very soft. This resulted in a significant amount of soil being mixed with each sample. The amount of coning and quartering necessary is directly related to the weight of the waste in the waste disposal truck.

The actual project was conducted on April 12th, April 13th , April 14th , April 17th and April 18th. Throughout the project the truck selection process ran smoothly. However, on the last day the WST experienced some procedural problems and the last three trucks were not included in the survey. Therefore, the sample size requirements were not met. As a result, the actual measurement performance was 90% confidence interval +/- 23%. A review of the data indicates that the overall sample included all of the waste types that enter the AL. Nevertheless, the random approach resulted in a representative sample of the incoming AL waste stream.

Waste Truck Weighing

The weighing of incoming waste disposal trucks was conducted with the scale at the landfill. There was concern expressed early on in the planning stages about the integrity and reliability of the Anguilla landfill scale. As a result, the Site Director performed an evaluation of the scale operation. Of particular interest, was the calibration procedure and frequency for the scale. The scale at the Anguilla Landfill has a manual method of determining the weight of materials on the scale. This scale is equipped with twenty pound incremental gradations. The scale is also equipped with an electronic digital readout device that appears to be able to measure to one-tenth of a pound.

On April 11, 2000, the WSC interviewed the Acting Supervisor of the Anguilla Landfill, Mr. Melbourne Peterson. Mr. Peterson indicated that the scale had not been calibrated for several years and therefore, should not be relied upon. He also indicated that his requests to upper management to have the scale maintenance program implemented were not addressed due to funding and other reasons.

Chief Archie Corbitt shared some institutional memory concerning the maintenance of the Anguilla Landfill scale. Mr Corbitt corroborated Mr. Petersen's assessment of the scale and indicated that the scale at the AL scale house could not be relied upon for making accurate measurements due to its' lack of a regular maintenance/calibration program. Further, he stated his Division is not equipped with the standard equipment necessary to attempt to calibrate the AL scale. Therefore, the scale could not be calibrated prior to initiating the project. Secondly, even if there was sufficient lead time available, funding was not appropriated for this function. It should be noted here that the Department of Public Works is responsible for operation of the AL and for maintenance and calibration of the AL scale.

A review of the calibration history of the scale revealed that the main scale (i.e., scale without the digital readout device) had an inspection sticker on it indicating that it was last inspected and calibrated in April of 1996. The electronic digital readout device which is connected to the main scale had an inspection sticker on it dated 1998. Therefore, the Anguilla Landfill scale has not had a recent inspection/calibration. This is a significant issue since this information triggers the amount of coning and quartering necessary to collect a four-hundred pound sample. An inaccurate estimate of the weight of the incoming waste would carry over to the estimate of the four hundred pound sample.

Given the above situation, the Site Director decided to incorporate a quality control procedure to check the real-time (i.e.,during the survey) precision of the scale. This procedure involved making duplicate measurements of the selected incoming waste disposal trucks. These measurements would be used to determine if the scale measurements were reproducible and repeatable. Simply put, we wanted to know whether the scale was able to weigh the same object twice satisfactorily.

The results of performing duplicate measurements using the AL main scale produced acceptable results. The spread or range of duplicate measurements were small enough for us to trust that the scale could be used to produce precise enough results of the weight of the waste trucks. This should not be confused with the accuracy of the scale which can be described as the ability of the scale to render the true weight of the object being weighed. As stated earlier, the accuracy of the main scale could not be assessed since standard materials were not available.

Once the project began, each incoming waste disposal truck was weighed twice. This information was inspected regularly so that we could quickly identify any large discrepancies between duplicate measurements. The results throughout the project were satisfactory and no problems with the main AL scale were observed.

Coning and Quartering

The purpose of the coning and quartering (C/Q) activity is to estimate a four hundred pound waste sample out of the entire truck load of waste which is always expected to exceed four hundred pounds. Once obtained, the four hundred pound sample was then divided into two 200-pound loads so that two three member teams of sorters could sort the load. Once the weight of the load was determined that information would be used to determine how much C/Q is necessary to get to the four hundred pound sample. Initially, the plan was to use hand radios to inform the main sorter of the amount C/Q necessary to get a four-hundred pound sample. However, the radios did not work, therefore, Site Director and Assistant would alternate accompanying the truck to the main sort area and relay the information to the senior sorter. This modification worked well throughout the project.

The C/Q sampling technique is regarded as an appropriate method for these types of projects. However, it is important that the equipment and the surface of the area designated for conducting the C/Q technique be suitable for the project. In this case, a bulldozer was used to conduct the C/Q

activity. Upon reflection, the project would have benefitted greatly by a better choice of the location used for the C/Q activity and a different type of heavy equipment. The bulldozer, while available when needed, had to traverse the C/Q area several times and this made the surface so soft that the C/Q became more challenging and exacerbated the dust problem as the project proceeded. Also, the limited versatility of bulldozer adversely compromised its' ability to carve out a sample representative of the waste load. Therefore, a backhoe or some other type of heavy equipment dedicated to the project would have been a better choice for this important activity. As result of the above situation, at times an inordinate amount of dust was generated and this made the work somewhat difficult at times.

Sorting

The waste sort area was set up with the fifty-five appropriately labeled waste containers. The waste sort team was divided in two groups of three. Each group sorted a 200 pound sample by placing the waste items in the pre-designated categories listed on the individual waste containers. The senior waste sorter was available to make decisions on items that were difficult to categorize and to resolve other real time issues that may arise. It was determined prior to the inception of the project that primarily household loads need to be sorted. Throughout the project thirteen loads of household loads arrived. In each case, the sorting was conducted without any major problems.

Waste Container Measurement System

The waste container measurement system consisted of a scale, and a range of standard weights approved by the National Bureau of Standards. This scale is used by the Division of Weights and Measurements to perform their routine official checks of commercial scales used to weigh consumer goods and produce. The operating range of the scale was sufficient to conduct the desired measurements.

Scale Calibration

Mr. Corbitt, subjected the scale to a calibration check on a daily basis. The scale was tested for accuracy throughout the operating range of the scale. The scale successfully passed the calibration

check and, therefore, was deemed satisfactory for weighing the waste containers to determine the net weight. Although the scale was slightly affected by wind, the area selected for accomplishing this task minimized the impact of the wind on the results.

Waste Container Weighing

The purpose of this phase is to record the net weight of the waste in waste containers. Once the waste disposal trucks were directed to the waste sort area, the WST would sort the waste according to the pre-designated categories and corresponding labels placed on the waste containers. At the end of each day the labeled waste containers along with the sorted waste was transported to the weighing area where the containers were weighed. Since there were fifty-five waste containers, it was important to determine how much each container weighed so that weight could be subtracted from the weight of the container and the waste and thereby determine the net weight of the waste.. To accomplish this, Mr. Corbitt selected a random sample of ten containers and weighed each of them. The results indicated that each of the containers weighed close enough to 24 pounds that this value could be used as the average weight of each container. At the end of every day the waste containers were weighed and the weight of each waste type in the container was recorded on the field data sheet.

Results

As stated in the prologue of this report, one of the objectives of the study is to determine whether the previously estimated 120,000 tons of solid waste entering the Anguilla Landfill, is valid. During this survey 32 trucks were sampled. Therefore, the ratio of the weight in pounds of solid waste disposed by the 32 trucks versus the 32 trucks, multiplied by the estimated number of trucks per month, times 12 months per year, and divided by 2000 pounds per ton, provides an estimate of the annual amount of solid waste disposed of per year.

(165,330 lbs. of SW/32 trucks)(3500 trucks per month)(12 months per year)/(2000lbs. per ton)=108,497.8 tons per year.

In addition to the above, the survey produced the following relative percentages.

Waste Type	Percentage
Paper	9.82
Plastics	5.67
Glass	3.19
Metal	19.64
Compostable Organics	38.52
Other	23.15

Detailed data analyses of the results of the waste sort are available in the Technical Report.

- Importance of Up-front Planning and Upper Management Involvement

  Planning is the most important component of a data operation. I t allows decision makers to save resources and streamline data collection and increase the likelihood of collecting appropriate data. The ALBC should be commended for maximizing the planning process. Other agencies could benefit from the approach employed by the ALBC.

  Although the DPW did support the implementation of the project the Government of the Virgin Islands could have reaped greater benefits by getting involved in planning and determining how this survey could produce more specific information to aid in the search for comprehensive solid waste solutions.

- Personal Protective Equipment

Since all types of waste including hazardous materials are disposed of at the AL, it would have been more protective to have available equipment that would prevent exposure to hazardous materials.

- Recommendations

In 1991,the Department of Public Works and the Virgin Islands Energy Office sponsored a workshop on "Recycling in the Virgin Islands" and issues a report dated February, 15, 1991. GBB ,solid waste management consultants, prepared another report for the Department of Public Works in January 1994 titled

"Report on Markets and Marketing Barriers". Therefore, the information generated in the Anguilla Waste Sort Project should be used to:

- help the GVI develop a solid waste policy outlining our preferences for how solid waste should be managed;
- promote recycling in our community through education;
- develop legislation to promote and encourage recycling;
- update our information base on available markets, possible local and on island users;
- determine whether the level of detail provided within categories (i.e., plastics) provides greater recycling opportunities or greater efficiency;
- compare marketability of source separated versus mixed waste processing; and identify and barriers to recycling and develop strategies to overcome them.

FINAL WASTE SORT REPORT

Technical Report
by

Deniz Ergun Seker

WASTE CHARACTERIZATION ANALYSIS

TABLE OF CONTENTS

LIST OF TABLES AND CHARTS

WASTE CHARACTERIZATION ANALYSIS

INTRODUCTION

History shows that the problem of trash disposal has been with us from earliest time. Four basic ways of dealing with trash have been used over and over in history;

- Dumping
- Burning
- Recycling
- Waste minimization

Landfills have been the most widely used solid waste management option. The first municipal waste site in Western Civilization is believed to have been established around 500 B.C. in Athens, Greece. The council of Athens had prohibited the dumping of garbage within one mile of the city wall.

For hundreds of years, people disposed of municipal solid waste by gathering it up and discarding it, by dumping or burying it in an isolated place. These methods worked well in the past, because most of the wastes consisted of biodegradable organic compounds that easily decomposed. That however, has become a thing of the past. Also in the past the volume of trash was much lower than at present. Over the last fifty years, new synthetic materials have been introduced into the waste stream, complicating and lengthening the process of decomposition. So much so that now our wastes are becoming environmentally dangerous, costly to clean up and more troublesome to discard.

How do we know what is being thrown into our landfills? What is in a typical trashcan in our community?

Municipal solid waste, more commonly known as trash or garbage; consists of everyday items such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paints and batteries. This is commonly generated from our homes, but it also comes from commercial, institutional and industrial sources.

A thorough knowledge of the local waste stream is essential for a successful solid waste management program. Armed with that knowledge, it will be possible to design an efficient waste reduction strategy that targets the most economically promising and most problematic materials first.

With this purpose, the “Waste Sort Project” was conducted by Antilitter and Beautification Commission at Anguilla Landfill, St. Croix, U.S. Virgin Islands from April 8 through April12, 2000.

This report presents the local waste stream analysis by providing detailed results of the project in five sections.

In the **first section** of this report, the methodology of the project is presented by giving statistical basics such as confidence interval, confidence level, sample size and weight.

The waste composition of St. Croix by major waste categories; Paper, Plastics, Glass, Metal, Compostable Organics and Other Waste, is presented in the **second section** of the report. In this part, the information from “Anguilla Landfill -1999 Records Database and Annual Waste Projection ”, which is an ongoing project by Antilitter and Beautification Commission, has also been provided by making the comparison to the current sort results.

Section 3 takes a closer look at each of the waste categories to get a better understanding of the major contributors to each category.

Section 4 presents the annual waste estimation for St. Croix. In this section, annual waste per capita is also given for St. Croix. The comparison to the GBB Waste Characterization Report (that summarizes the results of their 1993 waste sort) is also provided in this section.
The comparison of the place of each material in the waste stream to the GBB report is presented in **Section 5** of this report.

In the final part of the report, conclusions and recommendations are presented to address the importance of developing a successful solid waste management program.

Technical Report

Section 1

1-WASTE SORT METHODOLOGY

1.1. Confidence Interval and Confidence Level

During the planning stage of a waste sort, there are two major concerns; time and cost.
It is desired to minimize both the time and cost of the program, and to obtain meaningful results. The first step is to determine in advance the number of samples to be sorted. This, in turn, depends on the level of accuracy that is desired. For example, the higher the level of accuracy, the greater time required to complete the study and therefore the greater the cost.

For this study, it was determined that a 90% confidence level with +/- 20% confidence interval would provide meaningful results. Since the actual sample size and sample weight recorded during the waste sort was somewhat less than originally designed, the resulting confidence interval is slightly larger at +/-23%, while the confidence level is 90%, as designed. For further discussion on the sample size and weight, refer to the "Field Report".

1.2. Sample Size and Sample Weight

During the Waste Sort Project (WSP) week, 32 sample trucks, which was 3 trucks lower than the suggested level, were sorted. Total waste amount brought by these trucks was 165,380 lb. As it can be seen from the Table 1.4, the highest amount of sample waste came into the landfill during the second day of the project, which mostly consisted of yard waste.

From each truck, 2 samples (approximately 150 lb each), were pulled and from 32 trucks, totaling 64 samples were sorted. (See Table 1.2)

Sample distribution by the truck waste type has been presented in Table 1.3. This table shows that almost 75 % of the sample waste was household and yard waste, while 11 % of it was construction and demolition waste and 16 % was metal. (See Chart1.2)

Throughout the WSP, none of the selected trucks were loaded with tires. But the actual landfill records shows the existence of tire waste in the landfill. A very small amount of the waste (approximately 0.3-0.6 %) could be expected to be tires. (See "Anguilla Landfill-1999 Records Database and Annual Waste Projection" Report)

Total sample weight has been realized as 9,395 lb and the average sample weight per day was approximately 1900 lb. (see Table 1.1). While the average sample weight for the first three days was around 2300 pounds, the last two-day's productivity was approximately 1200 pounds only. (See Chart1.1). As a result of this, the average sample weight per sample was approximately 150 pounds, which is lower than the suggested level of 200 pounds.

Table 1.5 is presented to show all the detailed data on a daily basis. For each material sample weight and their percentages in the total can be examined from this table.

TABLE1.1.

SAMPLE WEIGHT BY DAY

TOTAL SAMPLE WEIGHT(Lb)	DAY 1	DAY2	DAY3	DAY4	DAY5
9,395	2338	2563	2106	1039	1349

TABLE1.2.

SAMPLE ANALYSIS BY TRUCK WASTE TYPE

WASTE TYPE	DAY 1	DAY2	DAY3	DAY4	DAY5	TOTAL
HOUSEHOLD	6	0	6	10	4	26
YARD WASTE	6	11	2	2	0	21
CONSTRUCTION/DEM	0	3	2	2	0	7
METAL	2	0	4	0	4	10
TOTAL	14	14	14	14	8	64

TABLE1.3.

SAMPLE DISTRIBUTION BY WASTE TYPE

HOUSEHOLD	41%
YARD WASTE	33%
CONSTRUCTION/DEM	11%
METAL	16%
TOTAL	100%

TABLE 1.4.

SAMPLE WASTE TRUCKS BY DAYS
(NET WASTE WEIGHT(Lb) FROM 32 SAMPLE TRUCKS)

	DAY 1	DAY2	DAY 3	DAY 4	DAY 5	
1st Truck	2640	27380	9120	3300	5260	
2nd Truck	760	11040	2900	2760	2980	
3rd Truck	1460	17900	1400	1160	2080	
4th Truck	6380	840	440	1860	2400	
5th Truck	9240	740	1680	9420	0	
6th Truck	80	11320	8120	6740	0	
7th Truck	1440	5100	680	6760	0	GENERAL TOTAL
TOTAL	22000	74320	24340	32000	12720	165380

TABLE 1.5.

WASTE SORT-MATERIAL WEIGHT-ANALYSIS FORM

P:1-A

	DAY 1 SAMPLE WASTE WEIGHT		DAY 2 SAMPLE WASTE WEIGHT		DAY 3 SAMPLE WASTE WEIGHT		DAY 4 SAMPLE WASTE WEIGHT		DAY 5 SAMPLE WASTE WEIGHT	
	2338		2563		2106		1039		1349	
MATERIALS	MATERIAL WEIGHT FOUND IN THE SAMPLE	%	MATERIAL WEIGHT FOUND IN THE SAMPLE	%	MATERIAL WEIGHT FOUND IN THE SAMPLE	%	MATERIAL WEIGHT FOUND IN THE SAMPLE	%	MATERIAL WEIGHT FOUND IN THE SAMPLE	%
NEWSPRINT	37	2%	0	0%	2	0%	13	1%	28	2%
OFFICE PAPER	53	2%	0	0%	5	0%	6	1%	39	3%
MAGAZINES	53	2%	0	0%	5	0%	42	4%	0	0%
OCC	71	3%	0	0%	12	1%	12	1%	28	2%
PAPERBOARD	54	2%	33	1%	238	11%	53	5%	0	0%
KRAFT PAPER	26	1%	0	0%	3	0%	0	0%	29	2%
OTHER PAPER	43	2%	0	0%	20	1%	5	0%	13	1%
PLASTICS	244	10%	29	1%	99	5%	37	4%	124	9%
PET BOTTLES (#1)	29	1%	0	0%	4	0%	4	0%	31	2%
HDPE NATURAL (#2)	30	1%	1	0%	14	1%	8	1%	37	3%
HDPE COLORED (#2)	26	1%	0	0%	11	1%	4	0%	28	2%
PVC BOTTLES (#3)	24	1%	26	1%	0	0%	0	0%	0	0%
LDPE (#4)	37	2%	2	0%	25	1%	8	1%	28	2%
POLYPROPYLENE (#5)	24	1%	0	0%	0	0%	0	0%	0	0%
POLYSTYRENE (#6)	25	1%	0	0%	6	0%	6	1%	0	0%
OTHER RIGID PLASTIC	49	2%	0	0%	39	2%	7	1%	0	0%
FILM PLASTIC	0	0%	0	0%	0	0%	0	0%	0	0%
GLASS	94	4%	41	2%	14	1%	38	4%	113	8%
CLEAR GLASS	36	2%	0	0%	8	0%	7	1%	0	0%
GREEN GLASS	28	1%	0	0%	5	0%	26	3%	38	3%
BROWN GLASS	30	1%	0	0%	1	0%	5	0%	44	3%
NON- CONTAINER GLASS	0	0%	41	2%	0	0%	0	0%	31	2%

CHART 1.1.

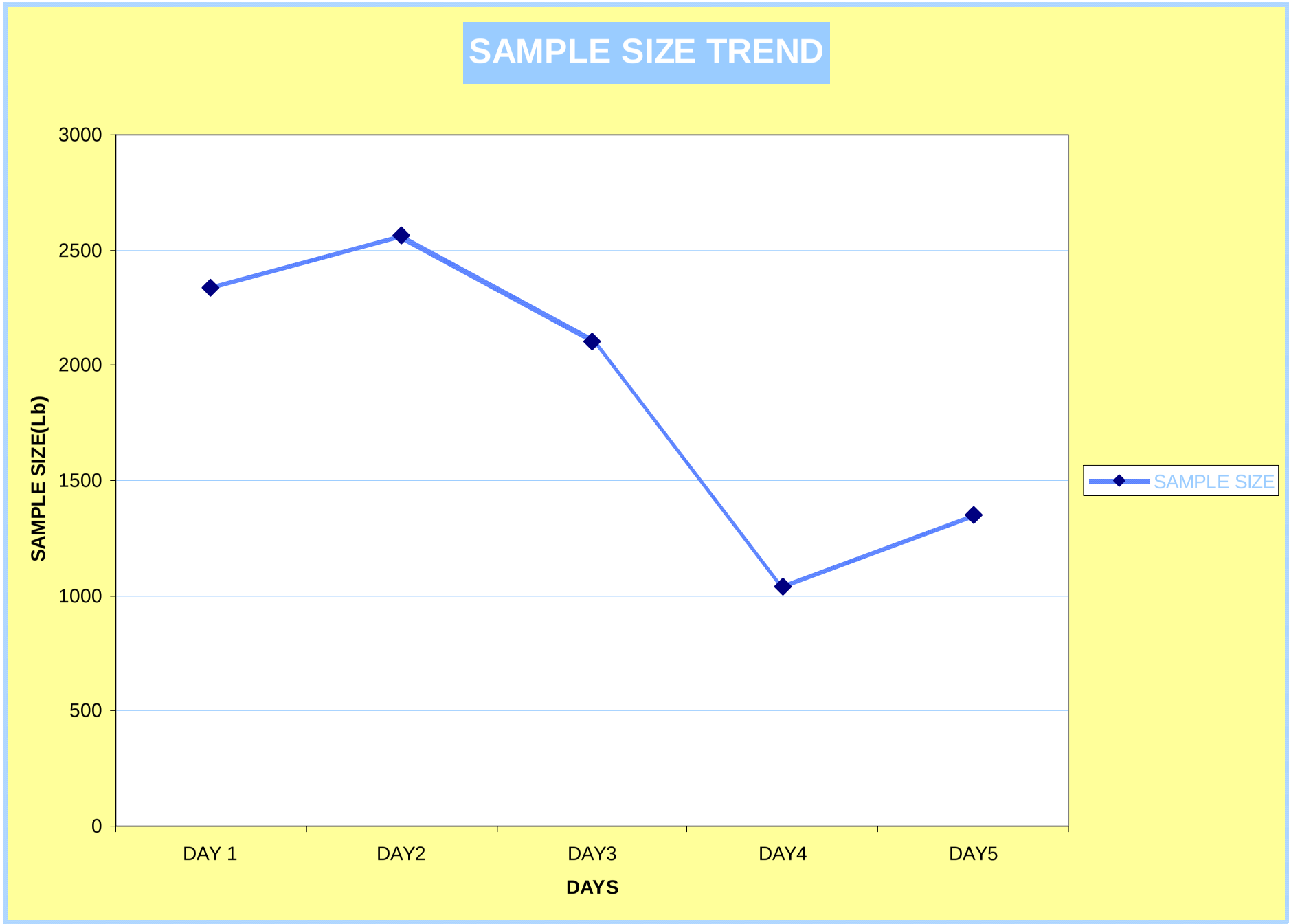
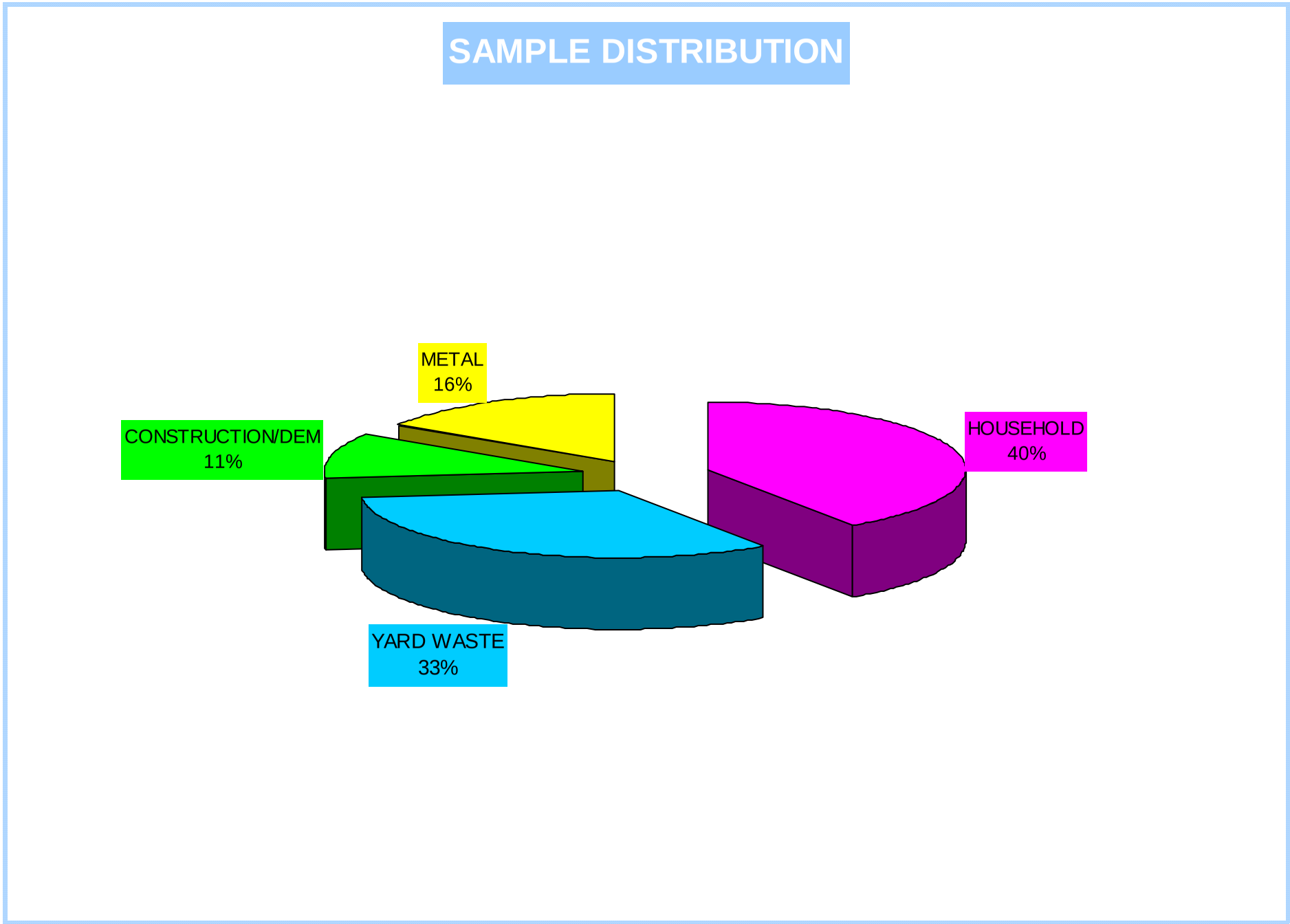

SAMPLE SIZE TREND
3000
2500
2000
1500
1000
500
0
SAMPLE SIZE(Lb)
DAY 1
DAY2
DAY3
DAY4
DAY5
DAYS
SAMPLE SIZE

CHART 1.2.


SAMPLE DISTRIBUTION
METAL
16%
CONSTRUCTION/DEM
11%
HOUSEHOLD
40%
YARD WASTE
33%

Technical Report

Section 2

2-WASTE STREAM COMPOSITION

The results of the WSP are summarized in Table 2.1 and Chart 2.1. The results show that the largest category belongs to “compostable organics” with 34% of the total waste stream. This category consists of mostly yard waste and smaller portions of food and wood waste. This result exceeds the national average and is representative of the primarily rural nature of the territory. Actual landfill records also confirm this finding.

The next largest category is “other waste” which make up 27% of the waste stream. These wastes include items composed of mixed materials such as, textiles, white goods and appliances and household hazardous waste.

“Metals” are the third largest category with 20%. This category consists of ferrous, non-ferrous and aluminum waste.

These are followed by “paper waste” at 10%, which is approximately one third of the national average. This is due to the fewer number and size of newspapers in the territory. Also this result represents a lesser level of businesses. This category consists of wastes such as paperboard, corrugated cardboard, newsprint and magazines.

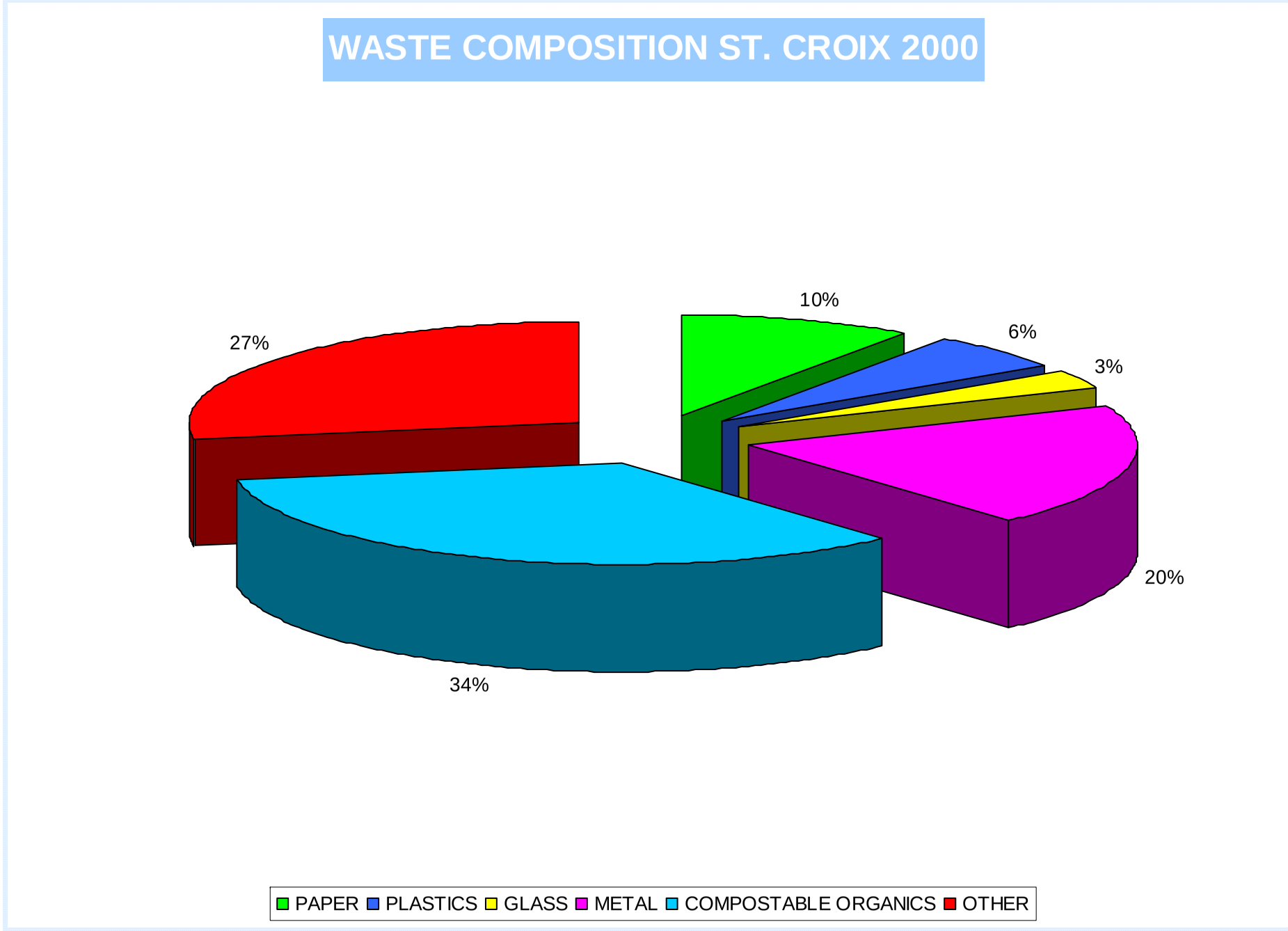
The next category is “plastic waste”, which make up only 6% of the total waste stream. While plastics are widely believed to be the major culprit behind our growing trash problem, the results of the WSP and other national records indicate otherwise.* Plastics' versatility has allowed it to be used in everything from car parts to doll parts, from soft drink bottles to the refrigerators they are stored in. This myth (of plastics being the major culprit) probably stems from the ever-growing presence of plastics in our daily lives.

Finally, the smallest category is “glass waste” with 3% of the total waste stream. This result is indicative of the diminishing role of glass in our daily lives compared with aluminum, plastics and aseptic packaging for juices, milks etc. which make-up most of the containers found on supermarket shelves.

TABLE 2.1.

WASTE COMPOSITION OF ST. CROIX	
MATERIAL GROUPS	PERCENTAGE
PAPER	9.82%
PLASTICS	5.67%
GLASS	3.19%
METAL	19.64%
COMPOSTABLE ORGANICS	34.26%
OTHER	27.41%

CHART 2.1


WASTE COMPOSITION ST. CROIX 2000
10%
6%
3%
27%
20%
34%
PAPER
PLASTICS
GLASS
METAL
COMPOSTABLE ORGANICS
OTHER

Technical Report

Section 3

3-WASTE CATEGORY BREAKDOWN

3.1.Paper

As shown in Table 3.1. and Chart 3.1., by far the largest contributor in this category is paperboard waste, which is mostly cereal boxes, milk and juice cartons, and the like.
Corrugated cardboard, newsprint, magazines and office paper are the other major contributors within this category.

National records indicate that newspapers alone may take up as much as 13 percent space of the landfills by volume. One research shows that a year's worth of copies of the New York Times has been estimated to be equivalent in volume to 18,660 crushed aluminum cans or 14,969 flattened Big Mac clamshells.*

Although it is not the situation in St. Croix, "paper" waste is still one of the highest consumer waste, more than plastic and glass waste.

3.2. Plastics

Chart 3.2. indicates that materials made from natural and colored H.D.P.E (High Density Polyethylene) with approximately 30 % within that category. H.D.P.E is mostly used in making large bodied small-necked bottles for milk, water, juice and liquid detergent bottles.

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* Source: American Plastics Council

Within that category, the materials made from L.D.P.E (Low Density Polyethylene) with around 20 % are the second highest type of waste. The usage of L.D.P.E is seen in the plastic grocery bags and food bags that are the inevitable part of our daily lives.

Other rigid plastics that consist of the materials that are made from all type of plastics such as PVC toys, wire and cable insulation have also an important share in plastic waste stream.
PET and PVC bottles that are very common items in roadside trash, have also a significant impact in the plastics waste stream, with a total of % 20.

Polypropylene, which is used in food containers such as margarine and ketchup bottles, and polystyrene which is widely used in food service applications such as foam cups and plates, take only 10 % place in the plastic waste stream.

Fast food packaging, foam and disposable diapers have acquired high visibility because they are so noticeable among casual litter, and people think the components of everyday litter are the same as landfill garbage.

3.3. Glass

As it is shown in Chart 3.3., green and brown glass, which are primarily used in making beer bottles, have the greatest share in the glass waste stream with more than 50 %. This number may rise at the peak of the tourist season. As a result, the impact of the glass waste in the general waste stream could be expected to rise.

Non-container glass is also a significant contributor in the glass waste stream. Non- container glass category includes items such as window glass, mirrors or light bulbs.

3.4. Metal

Among the metals waste, which is one of the highest components of the general waste stream, ferrous materials other than ferrous cans held a very significant share within that category. (See Chart 3.4.). This situation can be easily seen by visually inspecting Anguilla Landfill, which has 3 different sections for different kinds of waste. The section in which metal wastes have been placed, seems like a metal mountain.

The metals, which are represented in the food industry by ferrous and aluminum cans, have only 6 % share within the larger category. This type of waste in the landfill has been buried with household waste. Because of their usage in our daily lives, they are imported in large quantities. However, just like the plastics, we misjudge them. While the numbers are great, these items do not have as much impact, by

weight, in the general waste stream as much as it may seem.

3.5. Compostable Organics

As has been mentioned, compostable organics have been filling almost half of the Anguilla Landfill (See Chart 3.5.). In this category, yard waste has been the major contributor to the waste stream with around 85 %. While wood waste represents 14 % of the compostable organics waste, food waste has only 1 % share within the category.

The nature of the tropics and the rural characteristics of the island are the primary reasons for such a great percentage of yard waste in the waste stream. At this point, it can be said that encouragement for backyard composting, which is one of the oldest, simplest and most effective ways of reducing waste, could make such a great difference in the island's landfill composition.

Long before people inhabited the planet, composting just happened. In every swamp, forest and meadow – wherever there was vegetation – there was composting. Then, sometime in the distant past our ancestors noticed that crops grew better near piles of rotting manure and vegetation. The discovery was passed down to succeeding generations. Composting, the perfectly natural process that just happens, became something, which our ancestors learned to use.

One of the earliest references to compost use in agriculture appears on a set of clay tablets from the Akkadian Empire in the Mesopotamian Valley 1000 years before Moses. That old technique has now became a very common practice of waste reducing all around the world, and indicates that the islands would profit from its wider use.

Although food waste does not seems like a significant problem in the waste stream, there are very surprising findings in the Garbage Project research program*, that shows food waste and other organic wastes could be a problem in landfills.

During that program, the first question observers set out to answer was: After a period of 10 or 15 years, is there much identifiable paper and other organic debris remaining in a typical landfill? Or has it mostly been transformed into methane and humus?

This research indicated that when paper waste is combined with food waste, yard waste and wood waste, the overall volume of old organic material recovered largely intact (from the landfill excavated by the Garbage Project) turned out to be astonishingly high.

Researchers who dug down into old landfills found 25 to 50 year- old newspapers still perfectly readable and grass clippings that were still green, amazingly in the course of excavations, whole hot dogs were found. That research showed that degradation takes place very slowly in landfills. Rather than being vast composters, landfills seem to be vast mummifiers.

3.6. Other Waste

The composition of other waste types is shown in Chart 3.6.. Miscellaneous inorganics that are composed of mixed materials are the major component in that category with almost 70 %. These materials represent the waste products like furniture, pictures, lamps, and personal things such as umbrellas.

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* Source: American Plastics Council

Sort records indicate that 7 of the total of 64 samples consisted of construction and demolition waste, which is the primary contributor in the miscellaneous category. This type of waste has nearly 10 % of impact in the general waste stream.

White goods and appliances are the other significant contributors to the waste stream, a visitor to Anguilla Landfill can only wonder why so many household appliances are just lying in the ground and decaying.

TABLE 3.1.

SHARE OF WASTE TYPES WITHIN THEIR CATEGORIES

PAPER	**% IN PAPER**
NEWSPRINT	8.667%
OFFICE PAPER	11.159%
MAGAZINES	10.834%
OCC	13.326%
PAPERBOARD	40.953%
KRAFT PAPER	6.284%
OTHER PAPER	8.776%
PLASTICS	**% IN PLASTICS**
PET BOTTLES (#1)	12.758%
HDPE NATURAL (#2)	16.886%
HDPE COLORED (#2)	12.946%
PVC BOTTLES (#3)	9.381%
LDPE (#4)	18.762%
POLYPROPYLENE (#5)	4.503%
POLYSTYRENE (#6)	6.942%
OTHER RIGID PLASTIC	17.824%
FILM PLASTIC	0.000%
GLASS	**% IN GLASS**
CLEAR GLASS	17.000%
GREEN GLASS	32.333%
BROWN GLASS	26.667%
NON- CONTAINER GLASS	24.000%
METAL	**% IN METAL**
FERROUS CANS	1.626%
OTHER FERROUS	90.298%
NON-FERROUS	1.843%
ALUMINUM CANS	4.878%
OTHER ALUMINUM	1.355%
COMPOSTABLE ORGANICS	**% IN COMP.ORG.**
YARD WASTE	85.368%
WOOD WASTE	13.576%
FOOD WASTE	1.056%
OTHER	**% IN OTHERS**
TEXTILES	8.660%
RUBBER	0.000%
MISC.INORGANICS	70.447%
MISC. ORGANICS	2.019%
BATTERIES	0.000%
DIAPERS	2.058%
FINES	0.000%
HHW	0.893%
TIRES	0.000%
WHITE GOODS / APPLIANCES	15.534%
USED OIL	0.388%
USED PAINT	0.000%

CHART 3.1.

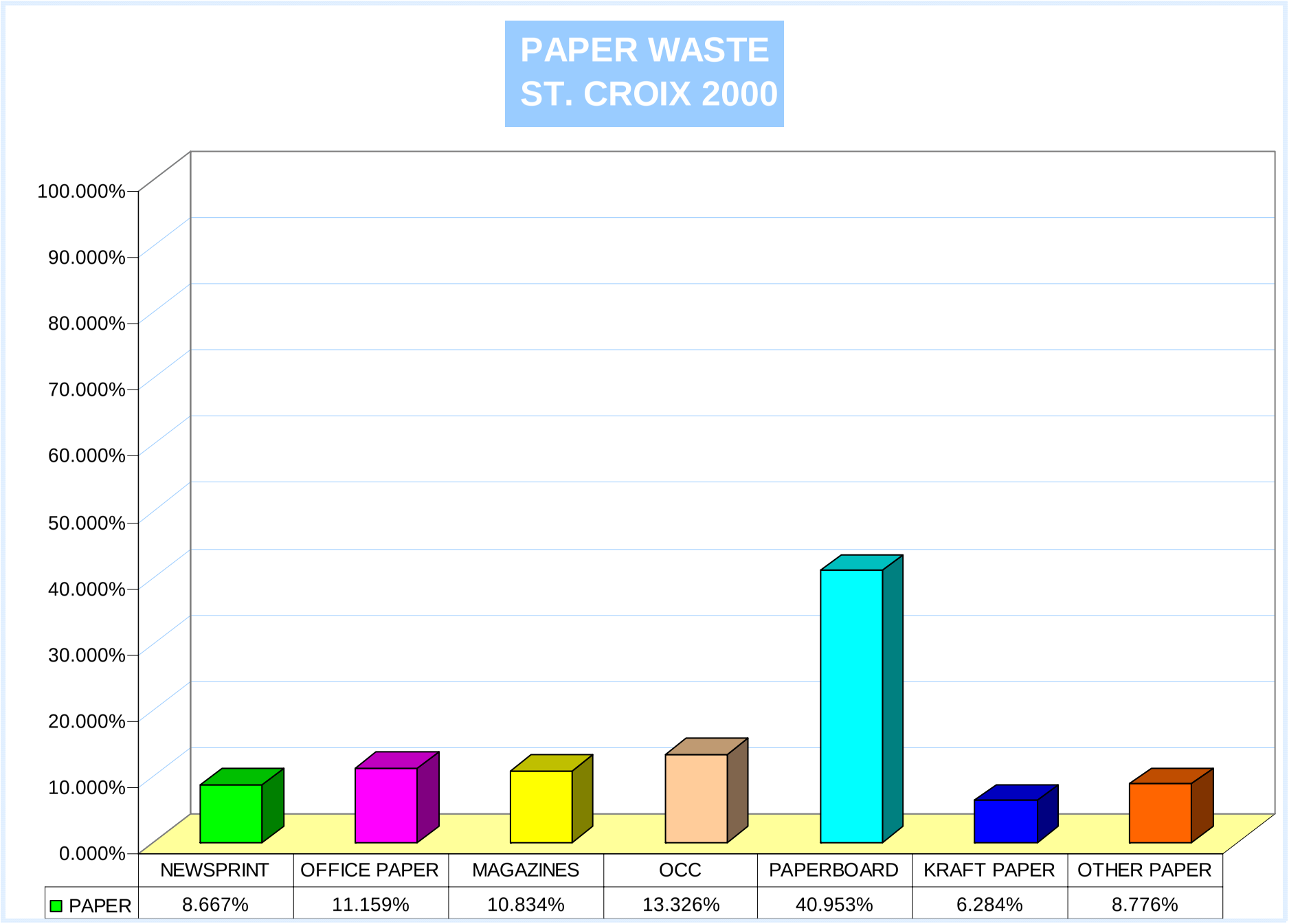

PAPER WASTE
ST. CROIX 2000
100.000%
90.000%
80.000%
70.000%
60.000%
50.000%
40.000%
30.000%
20.000%
10.000%
0.000%
NEWSPRINT
OFFICE PAPER
MAGAZINES
OCC
PAPERBOARD
KRAFT PAPER
OTHER PAPER
PAPER
8.667%
11.159%
10.834%
13.326%
40.953%
6.284%
8.776%

CHART 3.2.

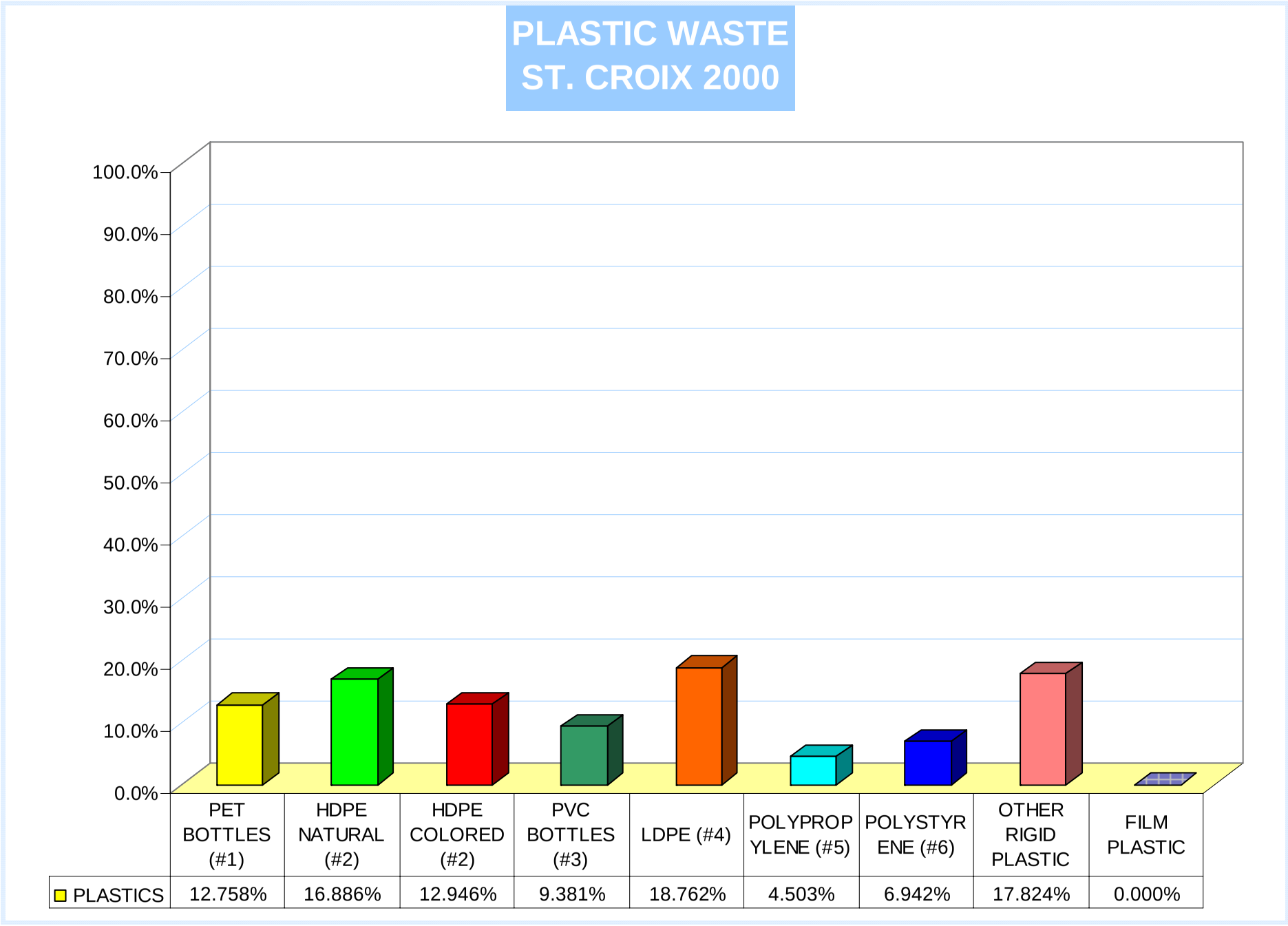

PLASTIC WASTE
ST. CROIX 2000
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
PET BOTTLES (#1)
HDPE NATURAL (#2)
HDPE COLORED (#2)
PVC BOTTLES (#3)
LDPE (#4)
POLYPROPYLENE (#5)
POLYSTYRENE (#6)
OTHER RIGID PLASTIC
FILM PLASTIC
PLASTICS
12.758%
16.886%
12.946%
9.381%
18.762%
4.503%
6.942%
17.824%
0.000%

CHART 3.3.

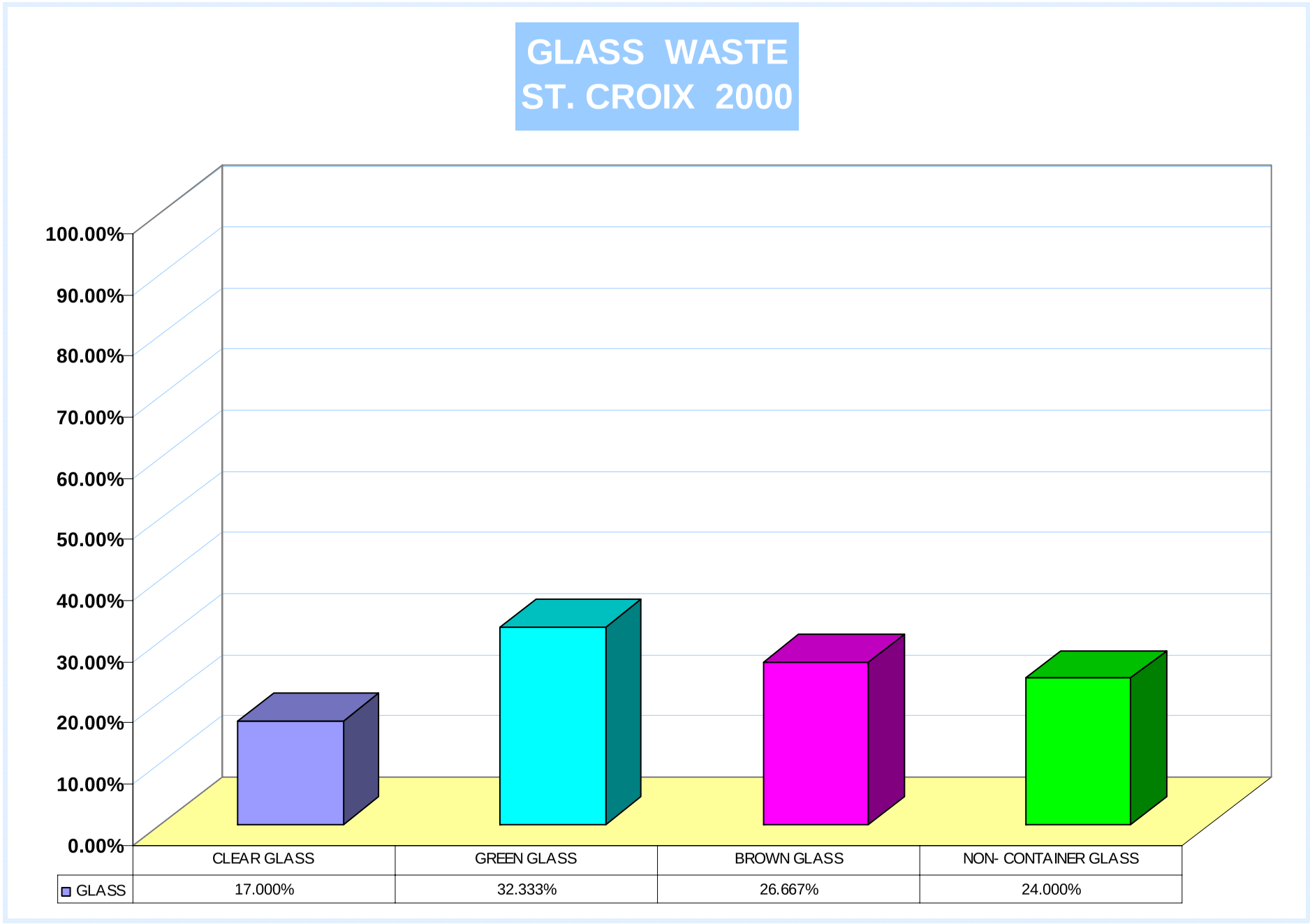

GLASS WASTE
ST. CROIX 2000
100.00%
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
CLEAR GLASS
GREEN GLASS
BROWN GLASS
NON- CONTAINER GLASS
GLASS
17.000%
32.333%
26.667%
24.000%

CHART 3.4.

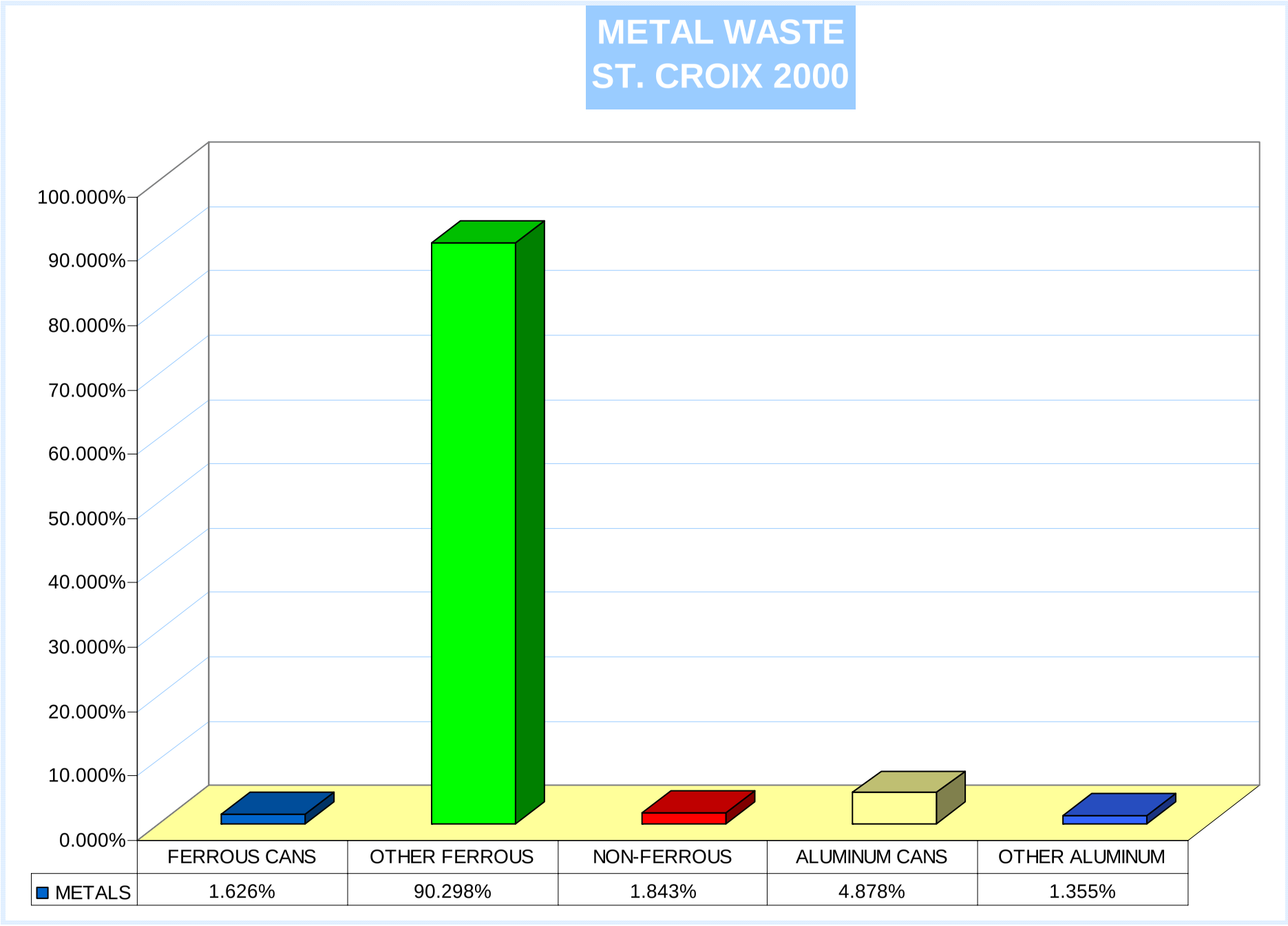

METAL WASTE
ST. CROIX 2000
100.000%
90.000%
80.000%
70.000%
60.000%
50.000%
40.000%
30.000%
20.000%
10.000%
0.000%
FERROUS CANS
OTHER FERROUS
NON-FERROUS
ALUMINUM CANS
OTHER ALUMINUM
METALS
1.626%
90.298%
1.843%
4.878%
1.355%

CHART 3.5.

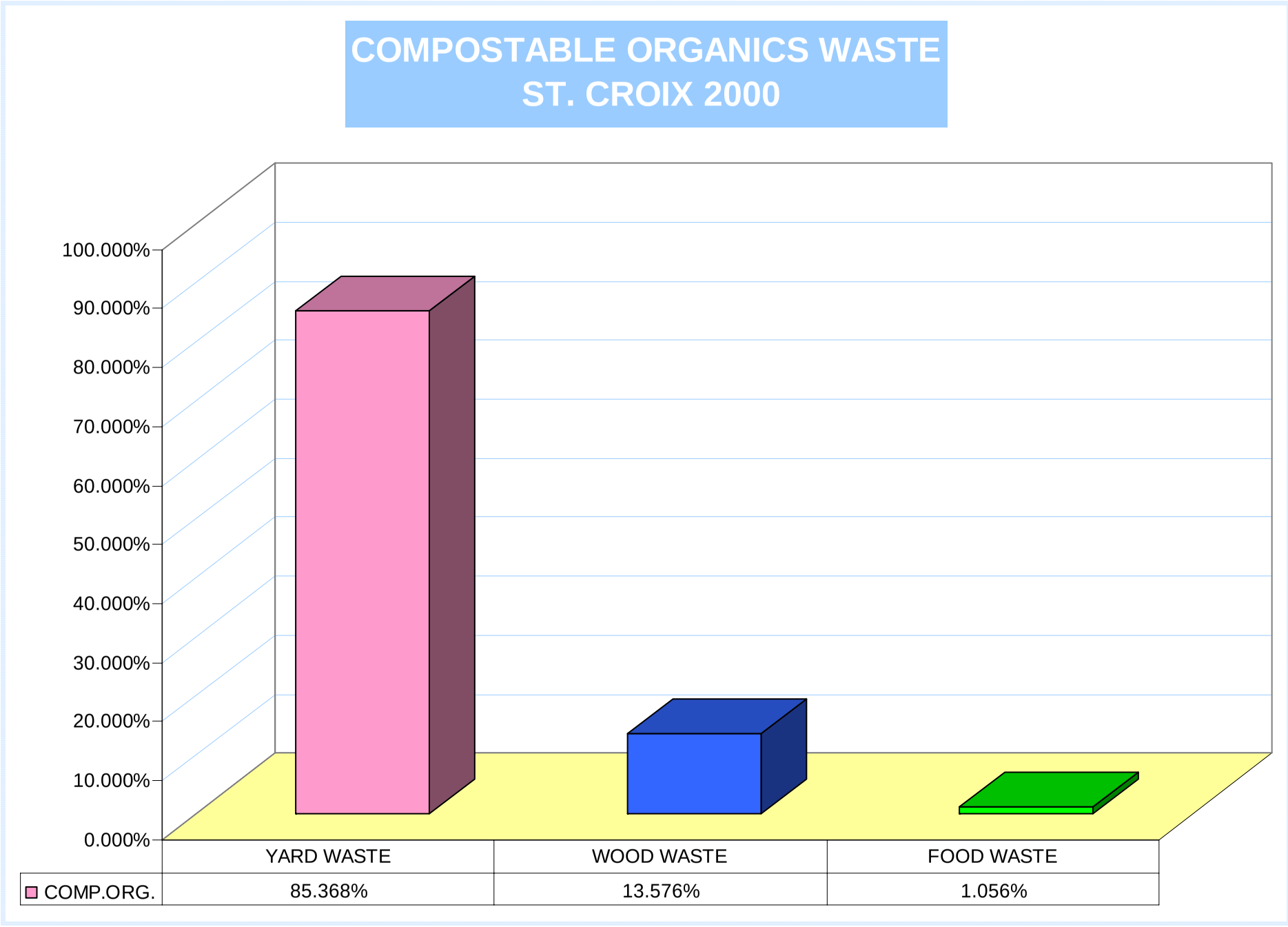
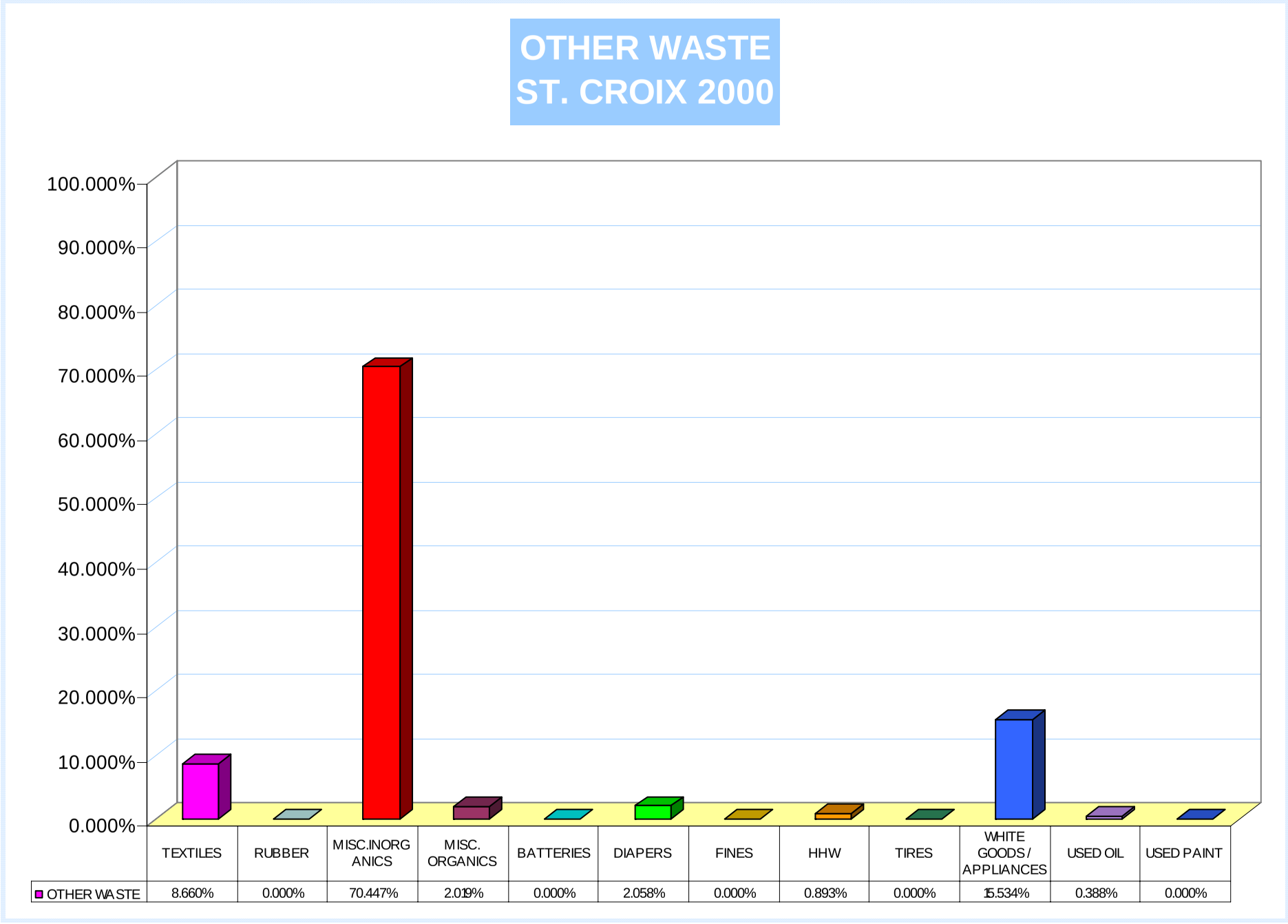

COMPOSTABLE ORGANICS WASTE
ST. CROIX 2000
100.000%
90.000%
80.000%
70.000%
60.000%
50.000%
40.000%
30.000%
20.000%
10.000%
0.000%
YARD WASTE
WOOD WASTE
FOOD WASTE
COMP.ORG.
85.368%
13.576%
1.056%

CHART 3.6.


OTHER WASTE
ST. CROIX 2000
100.000%
90.000%
80.000%
70.000%
60.000%
50.000%
40.000%
30.000%
20.000%
10.000%
0.000%
TEXTILES
RUBBER
MISC.INORGANICS
MISC. ORGANICS
BATTERIES
DIAPERS
FINES
HHW
TIRES
WHITE GOODS / APPLIANCES
USED OIL
USED PAINT
OTHER WASTE
8.660%
0.000%
70.447%
2.019%
0.000%
2.058%
0.000%
0.893%
0.000%
15.534%
0.388%
0.000%

Technical Report

Section 4

TABLE 4.1.

ESTIMATED ANNUAL WASTE - ST.CROIX-2000		
MATERIALS	ESTIMATED ANNUAL WASTE IN TONS	ESTIMATED ANNUAL PERCENTAGE
PAPER	**10662.46**	**9.82%**
NEWSPRINT	924.16	0.85%
OFFICE PAPER	1189.85	1.10%
MAGAZINES	1155.20	1.06%
OCC	1420.89	1.31%
PAPERBOARD	4366.64	4.02%
KRAFT PAPER	670.01	0.62%
OTHER PAPER	935.71	0.86%
PLASTICS	**6157.19**	**5.67%**
PET BOTTLES (#1)	785.53	0.72%
HDPE NATURAL (#2)	1039.68	0.96%
HDPE COLORED (#2)	797.08	0.73%
PVC BOTTLES (#3)	577.60	0.53%
LDPE (#4)	1155.20	1.06%
POLYPROPYLENE (#5)	277.25	0.26%
POLYSTYRENE (#6)	427.42	0.39%
OTHER RIGID PLASTIC	1097.44	1.01%
FILM PLASTIC	0.00	0.00%
GLASS	**3465.59**	**3.19%**
CLEAR GLASS	589.15	0.54%
GREEN GLASS	1120.54	1.03%
BROWN GLASS	924.16	0.85%
NON- CONTAINER GLASS	831.74	0.77%
METAL	**21313.36**	**19.64%**
FERROUS CANS	346.56	0.32%
OTHER FERROUS	19245.56	17.73%
NON-FERROUS	392.77	0.36%
ALUMINUM CANS	1039.68	0.96%
OTHER ALUMINUM	288.80	0.27%
COMPOSTABLE ORGANICS	37185.75	34.26%
YARD WASTE	31744.77	29.25%
WOOD WASTE	5048.20	4.65%
FOOD WASTE	392.77	0.36%
OTHER	**29746.29**	**27.41%**
TEXTILES	2576.09	2.37%
RUBBER	0.00	0.00%
MISC.INORGANICS	20955.25	19.31%
MISC. ORGANICS	600.70	0.55%
BATTERIES	0.00	0.00%
DIAPERS	612.25	0.56%
FINES	0.00	0.00%
HHW	265.69	0.24%
TIRES	0.00	0.00%
WHITE GOODS / APPLIANCES	4620.78	4.26%
USED OIL	115.52	0.11%
USED PAINT	0.00	0.00%
TOTAL	108530.63	100.00%

4. ANNUAL WASTE

While America as a nation generates about 200 million tons of solid waste, it is estimated that 108,530 tons of waste will be disposed at the St. Croix Anguilla Landfill in 2000, based on landfill records and the results of the project. It should be noted that this number is predicted within the limits of the previously mentioned confidence level and interval. Actually, previous landfill records indicate that the waste generation would be higher than that, up to 130,000 tons within the given confidence interval.

This quantity results in a projected per capita waste generation rate of approximately
12 pounds per person per day and around 4, 300 pounds per person per year. That is above the national average. It should be noted that the population of the island could fluctuate due to a tourist season and that numbers are calculated by taking the permanent population of St. Croix's residents.

Waste projection for 2000 by waste types is shown in Table 4.1.

Technical Report

Section 5

TABLE 5.1.

COMPARISON OF WASTE COMPOSITION-2000 VERSUS 1993

	WASTE SORT 2000		WASTE SORT 1993		
MATERIALS	**ESTIMATED ANNUAL WASTE IN TONS**	**ESTIMATED ANNUAL PERCENT-AGE**	**ESTIMATED ANNUAL WASTE IN TONS**	**ESTIMATED ANNUAL PER-CENTAGE**	**DIFFERENCE +/- %**
NEWSPRINT	924.16	0.85%	1775.34	1.68%	-0.83%
OFFICE PAPER	1189.85	1.10%	2019.37	1.92%	-0.82%
MAGAZINES	1155.20	1.06%	1305.12	1.24%	-0.17%
OCC	1420.89	1.31%	13467.43	12.78%	-11.47%
PAPERBOARD	4366.64	4.02%	2765.82	2.62%	1.40%
KRAFT PAPER	670.01	0.62%	1398.15	1.33%	-0.71%
OTHER PAPER	935.71	0.86%	6967.83	6.61%	-5.75%
PET BOTTLES (#1)	785.53	0.72%	376.21	0.36%	0.37%
HDPE NATURAL (#2)	1039.68	0.96%	519.26	0.49%	0.47%
HDPE COLORED (#2)	797.08	0.73%	606.36	0.58%	0.16%
PVC BOTTLES (#3)	577.60	0.53%	146.14	0.14%	0.39%
LDPE (#4)	1155.20	1.06%	n/a	n/a	n/a
POLYPROPYLENE (#5)	277.25	0.26%	94.56	0.09%	0.17%
POLYSTYRENE (#6)	427.42	0.39%	652.97	0.62%	-0.23%
OTHER RIGID PLASTIC	1097.44	1.01%	2262.75	2.15%	-1.14%
FILM PLASTIC	0.00	0.00%	3953.07	3.75%	-3.75%
CLEAR GLASS	589.15	0.54%	5017.21	4.76%	-4.22%
GREEN GLASS	1120.54	1.03%	3528.05	3.35%	-2.32%
BROWN GLASS	924.16	0.85%	3584.00	3.40%	-2.55%
NON- CONTAINER GLASS	831.74	0.77%	1161.89	1.10%	-0.34%
FERROUS CANS	346.56	0.32%	2973.84	2.82%	-2.50%
OTHER FERROUS	19245.56	17.73%	3084.00	2.93%	14.81%
NON-FERROUS	392.77	0.36%	699.94	0.66%	-0.30%
ALUMINUM CANS	1039.68	0.96%	603.09	0.57%	0.39%
OTHER ALUMINUM	288.80	0.27%	593.21	0.56%	-0.30%
YARD WASTE	31744.77	29.25%	6580.07	6.24%	23.01%
WOOD WASTE	5048.20	4.65%	5845.86	5.55%	-0.90%
FOOD WASTE	392.77	0.36%	16381.97	15.54%	-15.18%
TEXTILES	2576.09	2.37%	3302.97	3.13%	-0.76%
RUBBER	0.00	0.00%	538.64	0.51%	-0.51%
MISC.INORGANICS	25691.55	23.67%	5903.41	5.60%	18.07%
MISC. ORGANICS	600.70	0.55%	1652.87	1.57%	-1.01%
BATTERIES	0.00	0.00%	67.77	0.06%	-0.06%
DIAPERS	612.25	0.56%	3379.84	3.21%	-2.64%
FINES	0.00	0.00%	752.59	0.71%	-0.71%
HHW	265.69	0.24%	436.98	0.41%	-0.17%
TIRES	0.00	0.00%	991.42	0.94%	-0.94%
Total	**108530.62**	**100.00%**	**105390.00**	**100.00%**	

Approximately 5000 tons of white goods and appliances, used oil and used paint are included in the misc. inorganics category in the records of 2000.

COMPARISON OF ANNUAL WASTE ESTIMATION

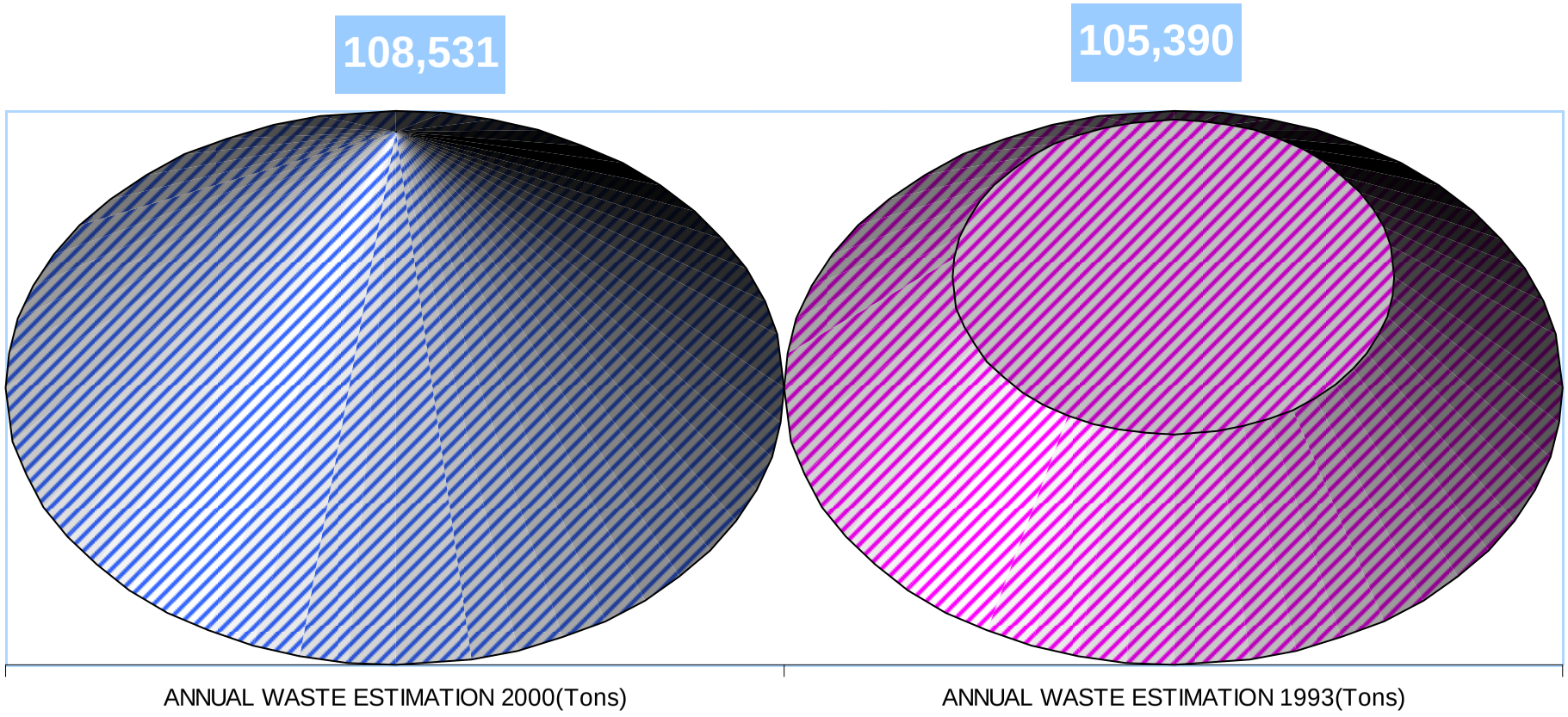
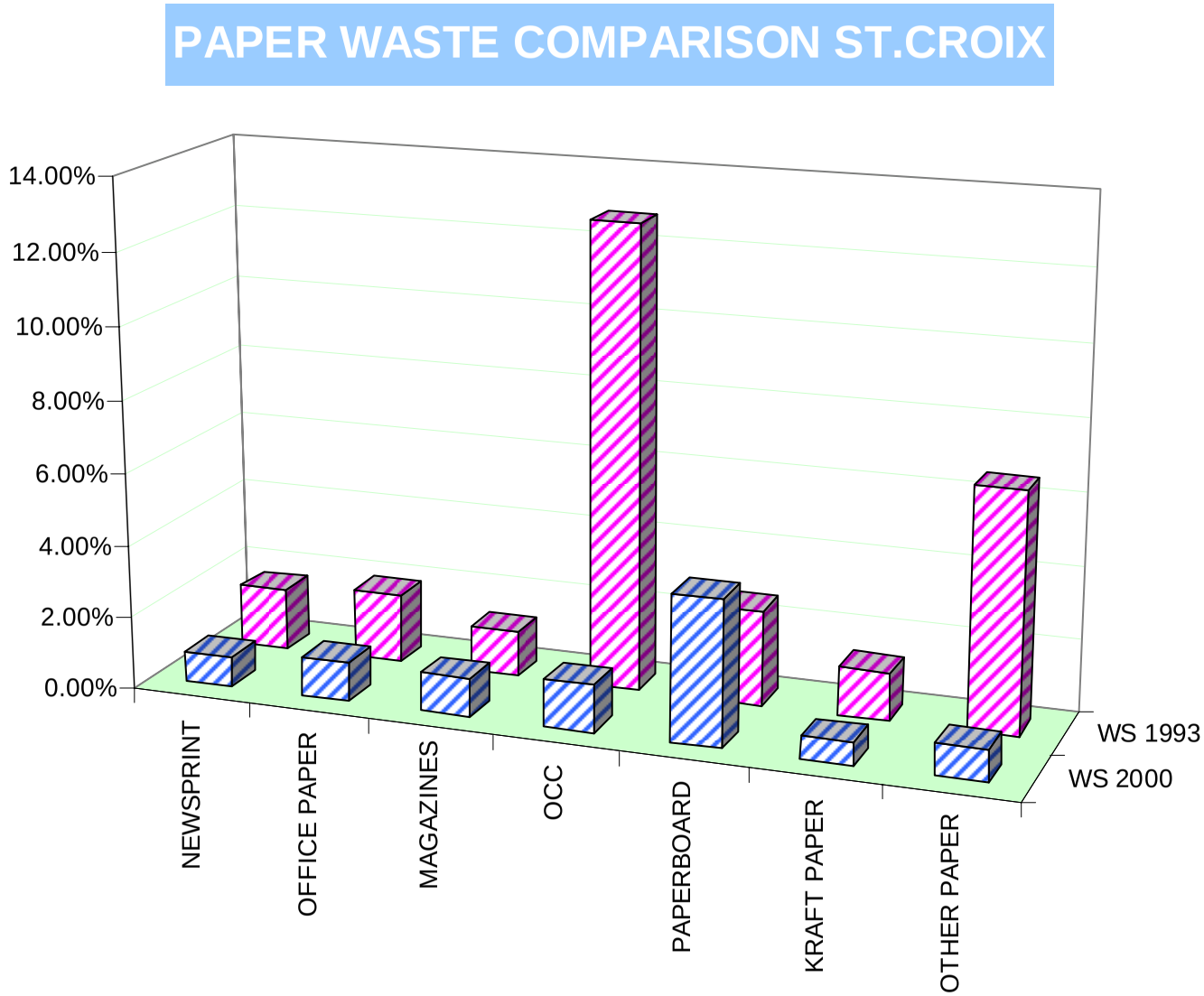
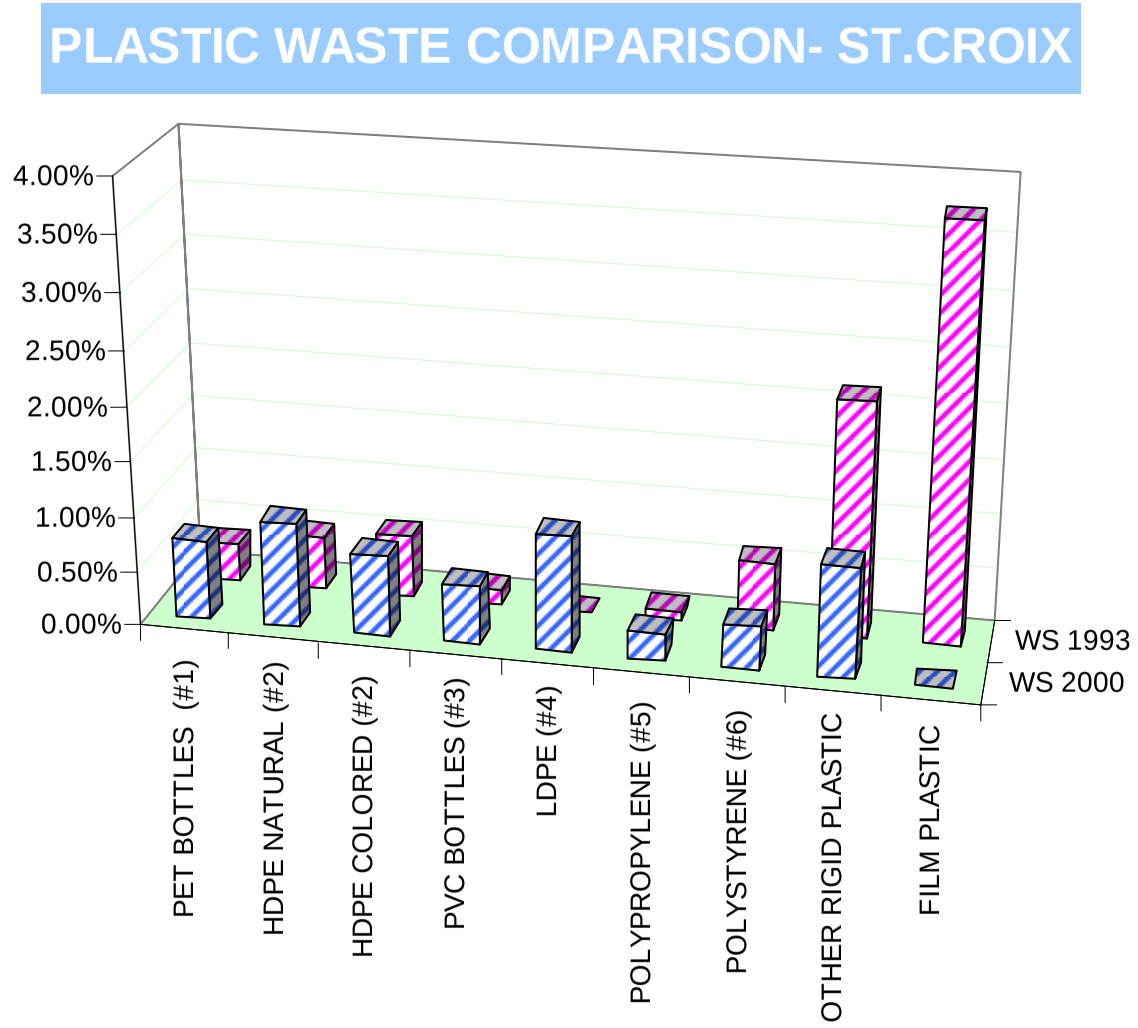


CHART 5.2.



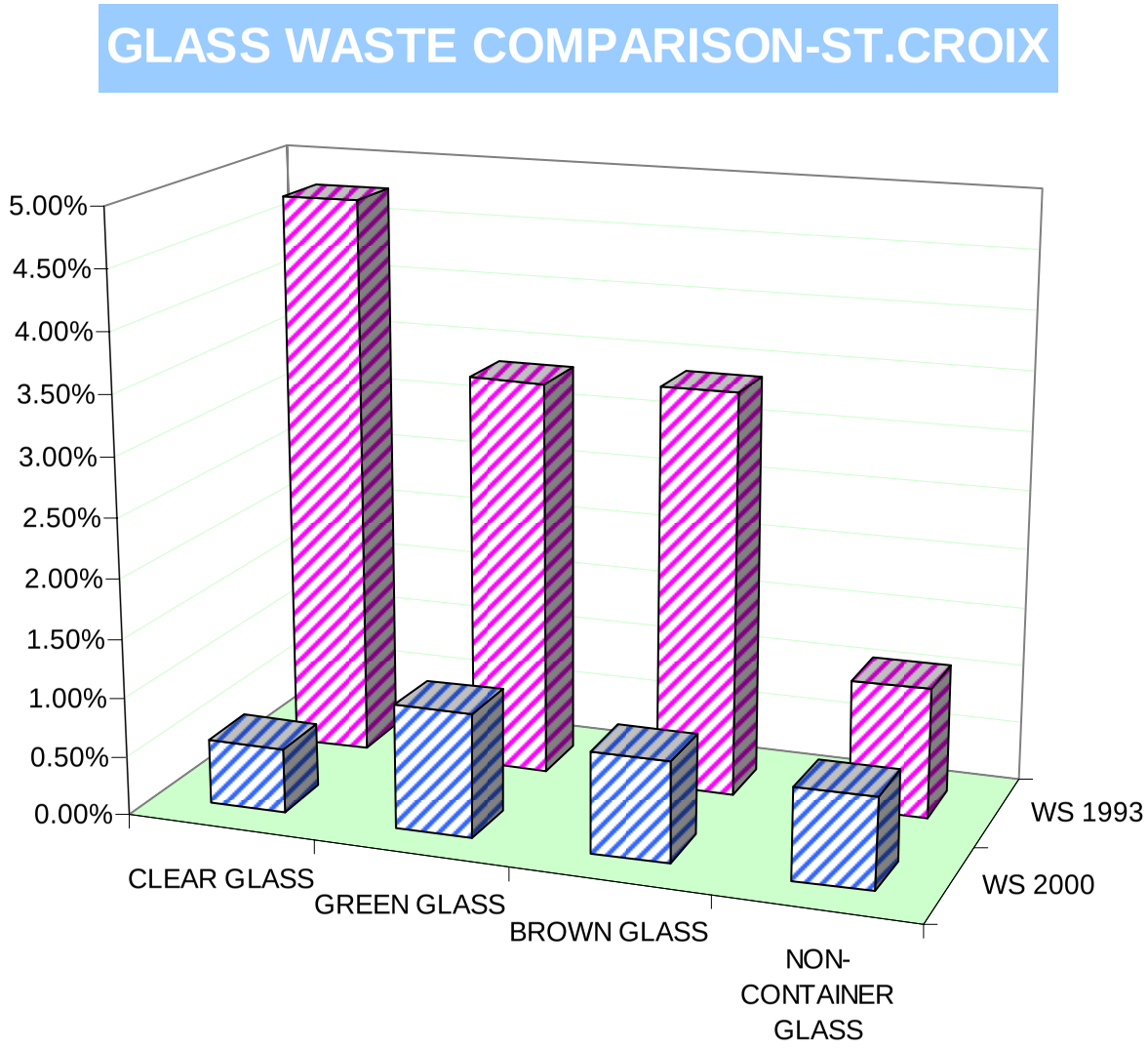
	NEWSPRINT	OFFICE PAPER	MAGAZINES	OCC	PAPERBOARD	KRAFT PAPER	OTHER PAPER
WS 2000	0.85%	1.10%	1.06%	1.31%	4.02%	0.62%	0.86%
WS 1993	1.68%	1.92%	1.24%	12.78%	2.62%	1.33%	6.61%

CHART 5.3.



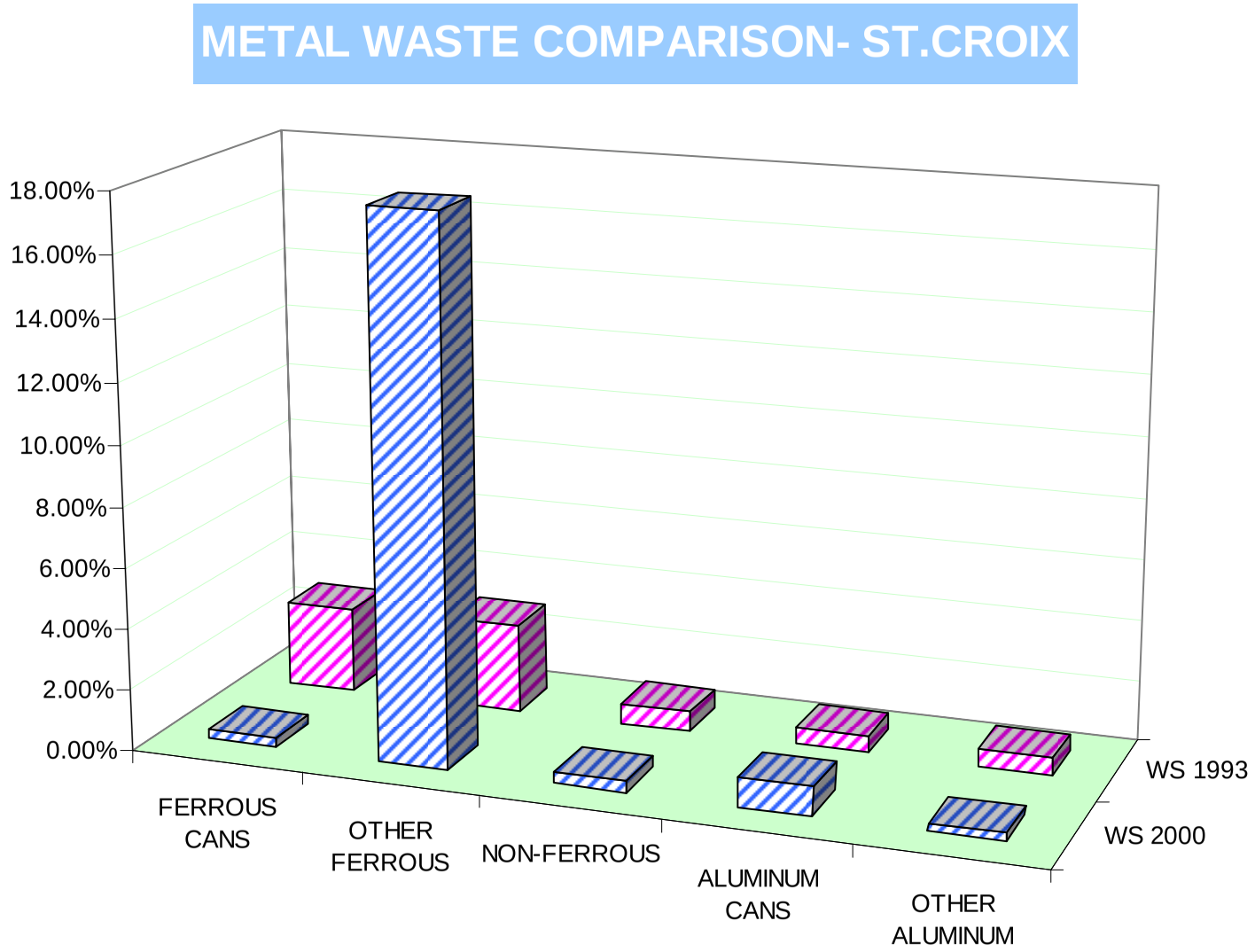
	PET BOTTLES (#1)	HDPE NATURAL (#2)	HDPE COLORED (#2)	PVC BOTTLES (#3)	LDPE (#4)	POLYPROPYLENE (#5)	POLYSTYRENE (#6)	OTHER RIGID PLASTIC	FILM PLASTIC
WS 2000	0.72%	0.96%	0.73%	0.53%	1.06%	0.26%	0.39%	1.01%	0.00%
WS 1993	0.36%	0.49%	0.58%	0.14%	0.00%	0.09%	0.62%	2.15%	3.75%

CHART 5.4.



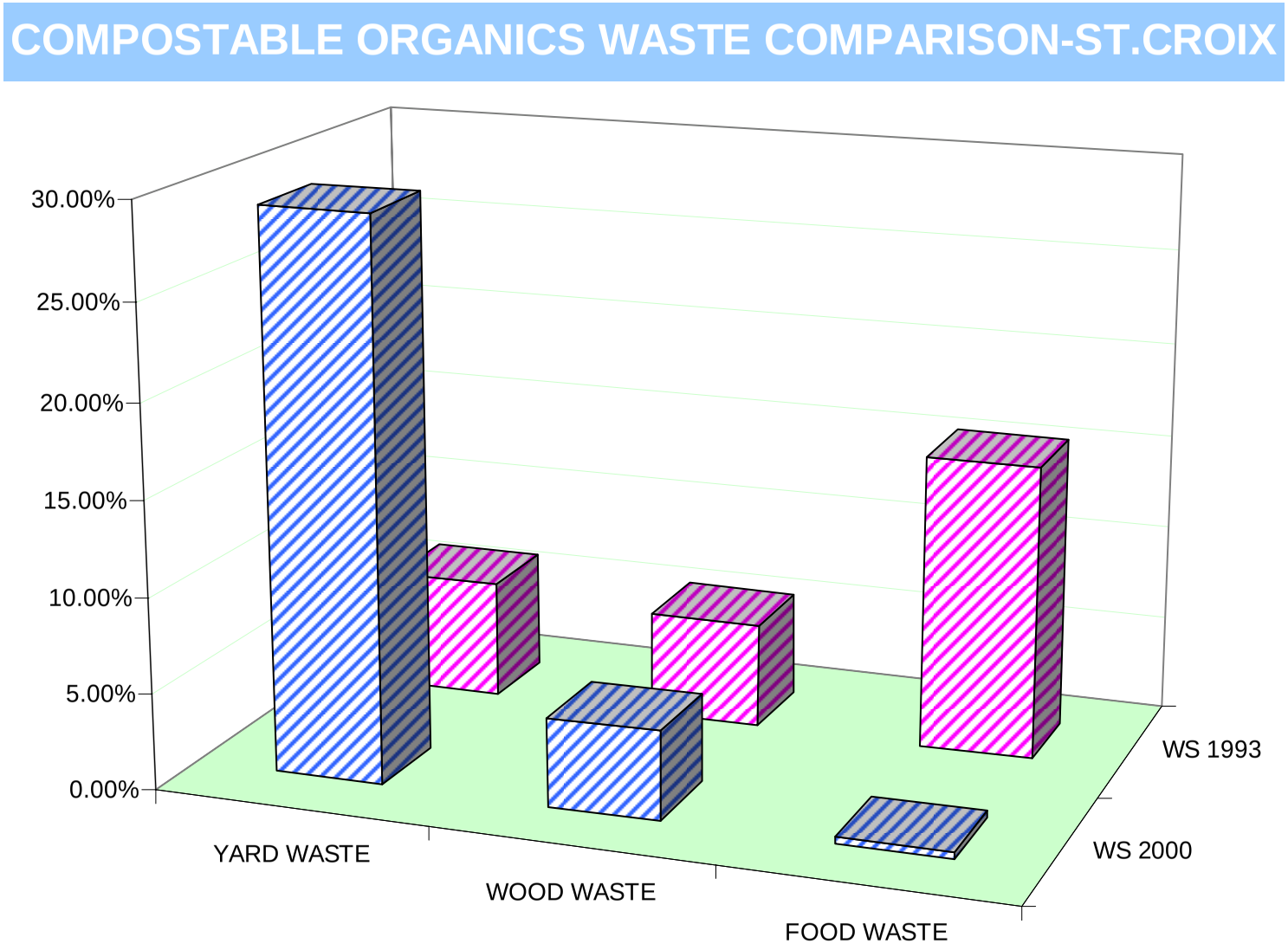
	CLEAR GLASS	GREEN GLASS	BROWN GLASS	NON- CONTAINER GLASS
WS 2000	0.54%	1.03%	0.85%	0.77%
WS 1993	4.76%	3.35%	3.40%	1.10%

CHART 5.5.



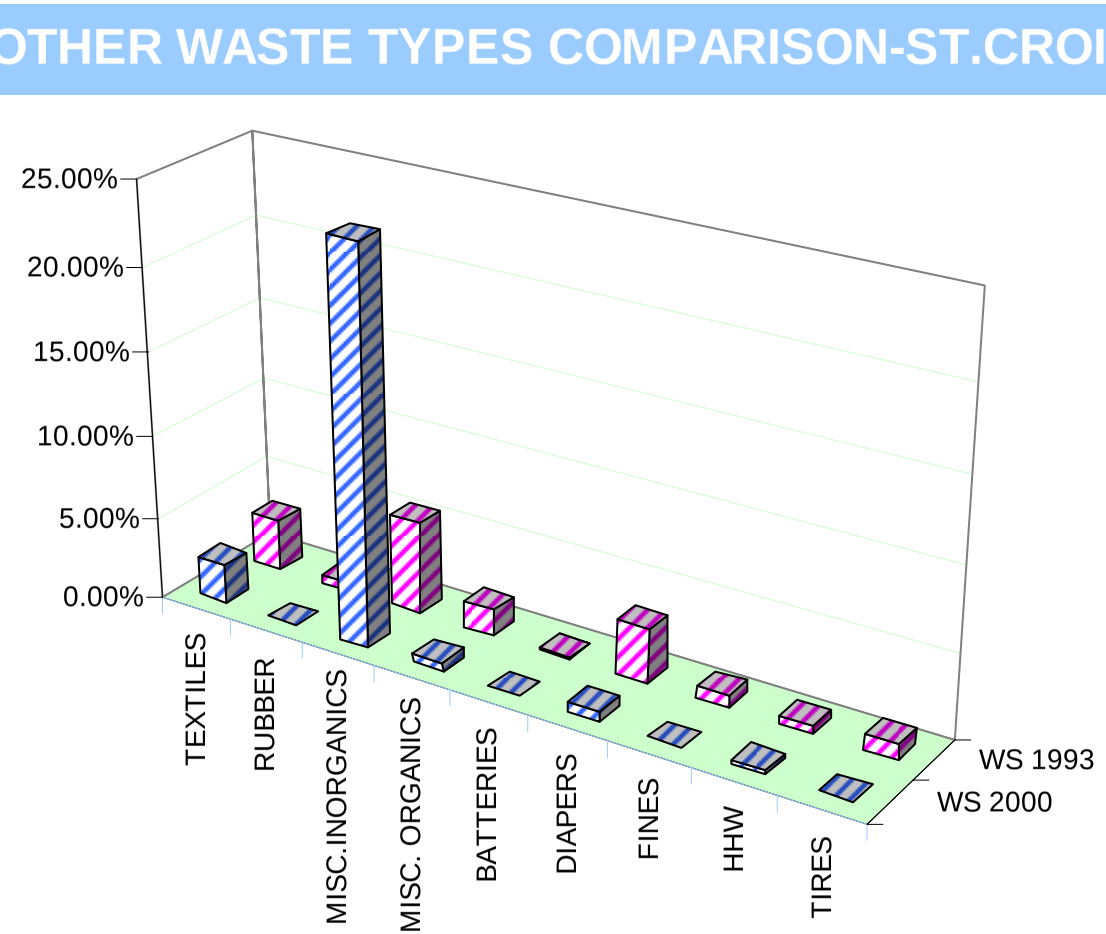
	FERROUS CANS	OTHER FERROUS	NON-FERROUS	ALUMINUM CANS	OTHER ALUMINUM
WS 2000	0.32%	17.73%	0.36%	0.96%	0.27%
WS 1993	2.82%	2.93%	0.66%	0.57%	0.56%

CHART 5.6.



	YARD WASTE	WOOD WASTE	FOOD WASTE
WS 2000	29.25%	4.65%	0.36%
WS 1993	6.24%	5.55%	15.54%

CHART 5.7.



	TEXTILES	RUBBER	MISC.INORGANICS	MISC. ORGANICS	BATTERIES	DIAPERS	FINES	HHW	TIRES
WS 2000	2.37%	0.00%	23.67%	0.55%	0.00%	0.56%	0.00%	0.24%	0.00%
WS 1993	3.13%	0.51%	5.60%	1.57%	0.06%	3.21%	0.71%	0.41%	0.94%

5. COMPARISON OF WASTE COMPOSITION - 2000 VERSUS 1993

Until the Waste Sort Project 2000, the last data on the waste composition of St. Croix was from 1993, which was the result of a study conducted by GBB Solid Waste Management Consultants. Therefore the comparison of the results of WSP 2000 is made against the only available data from 1993. (See Table 5.1)

When we compare the estimation for total waste generation in 2000 to the 1993 Waste Sort (WS 93) results, it can be seen that the general trend in waste has been increased in the last years. Chart 5.1. presents the comparison of the general waste stream, but it should be noted that the expected waste stream in 2000 would be up to 130,000 tons, as it has been mentioned before in Section 4,above. Therefore the gap between 2000 and 1993 results could be more than that shown in the chart.

When comparing the results of the two surveys, it is more appropriate to make it by percentages, since the total annual waste has increased by a significant amount.

5.1. Paper

In the paper waste category, the biggest difference between the two studies is seen in cardboard waste, as it is shown in Chart 5.2.. If we compare the current results for cardboard with the historical landfill records for 1999, we see that the two results are in agreement. However, when we compare with the results of WS 1993, a significant reduction is seen in cardboard waste. Since the actual landfill records confirm the recent study, 13 % of such a high cardboard waste in 1993 waste stream appears to be anomalous.

The other significant decrease in the waste stream is seen in other paper category. It should be noted that the recent study covers the wastes such as wax paper, carbon sheets, blue prints and paper towel like material in the other paper category. Since the term "other" is not well defined and could be very wide it is more appropriate not to make a one to one comparison between the two surveys.

5.2. Plastics

When plastics are compared, the results of both studies are in harmony. (See Chart 5.3.) The only noticeable difference appears in L.D.P.E. and film plastics, which can be explained by the fact that L.D.P.E is used in film plastics, therefore the difference is one of definition.

5.3. Glass

Chart 5.4. shows that the share of glass waste in the general waste stream has appeared to decrease by a small percentage in 2000. This may stem from the fact that although the recent study represents the average waste composition, it should be noted that the tourist season can increase the average amount of glass waste in the general waste stream, during that period. This would increase the overall total.

5.4. Metal

As mentioned in Sections 3 and 4, metal waste is expected to be one of the major components of the general waste stream in year 2000. As can be seen from Chart 5.5., the impact of the metals waste appears to increase significantly amount compared to the GBB study.

This could be explained as a one-time result as a representative of the current increased level of construction activities on the island such as the coker plant construction in Hovensa and the latest campaign for junk car removal. During WSP 2000, it was indeed observed that the number of trucks loaded with metal waste increased due to these mentioned reasons.

5.5. Compostable Organics

When the predicted results for compostable organic waste (the major waste contributor in the general stream in 2000) is compared to the results of WS 93, the yard and food waste composition seems quiet different. But when the same comparison is made with the historical data of Anguilla Landfill (1999), the actual data from the records confirms the findings of the recent study. But it should be noted that the climatic differences such as a very dry year could significantly affect the impact of this specific category in the general waste stream.

5.6. Other Waste

As can be seen from Chart 5.7., "miscellaneous inorganic" waste is the most important reason for such a big difference in the "other waste" categories. While the impact of other waste types, which took place in this category, such as textiles, household hazardous waste, diapers in the general waste stream, remained unchanged, the impact of the miscellaneous inorganics waste, which covers construction and demolition waste, increased.

However, because miscellaneous inorganics waste, as the name suggests, is not well defined, it would be appropriate not to make one-to-one comparison with the previous study.

As it is mentioned before in Section 3 and 4, since the category is so wide, it would be more reasonable to draw conclusions by evaluating the results individually instead of making comparison with the results of previous studies.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- The total amount of waste disposed in Anguilla Landfill is projected to be approximately between 110 and 130 thousand tons in year 2000.

- Compostable organic waste, which consists mainly of yard waste has the greatest impact with nearly 35 % in St. Croix' s general waste stream, as a result of the natural characteristics of the island.

- Due to the recent construction activities in the territory and the campaign for junk car removal, metal waste is expected to be the second highest major waste category in Anguilla Landfill for the year 2000. Ferrous waste items are the major component of this category.

- Construction and demolition waste, which is the major component of miscellaneous waste category, also represents a significant portion of the general waste stream.

- Although much lower than the national average, the results of the study indicate that paper waste is projected to be one of the major contributors to St. Croix' s general waste stream.

- Although the other waste types appear to have a higher impact in the waste stream, the amount of plastics and glass waste is also high enough to consider them as worthy for recycling businesses.

Recommendations

Yearly, with over 100 thousand tons waste disposal, the disposal capacity of Anguilla Landfill, which is already facing problems such as landfill fires, would soon reach to critical points.

As the quantity of solid waste grows, concern for its safe and efficient management grows too. As a requirement of effective waste management, an integrated approach covering a number of waste management methods that work compatibly has to be adopted.

An integrated waste management system contains a combination of the following methods:

Conclusions and Recommendations

- Source reduction
- Recycling of materials (Including composting)
- Waste combustion (With energy recovery)
- Landfilling

Source Reduction

Reducing the quantity of the waste generated should be one of the highest solid waste management priorities of the island.

Source reduction efforts should be mainly focused on the promotion of the backyard/ on-site composting for the residential organics and yard waste.

In addition to these efforts, simple but effective mandatory and/ or voluntary programs could be developed to encourage reducing the waste. (Such as material waste exchanges, increasing use of electronic mail instead of copies, decreasing of the packaging material, utilizing of reusable bags for shopping and education of the residents on reusing the materials.)

Recycling (Including composting)

Adopting a very comprehensive recycling and composting program is the major step that should be taken.

The organic fraction of the island's waste stream has great potential for composting. Composting may represent the greatest potential for turning compostable materials into value-added products. Besides composting, organic materials can be made into beneficial products including mulch and additives for on- farm composting, animal feed, animal bedding, biofuel and landfill cover.

One or a combination of the following techniques that are commonly used in the world could be recommended for reducing the yard waste:

- Backyard Composting

The simplest and cheapest way to reduce the amount of the waste that goes to the landfill is backyard composting. Encouragement of backyard composting could be provided by distribution of composters and/or establishing a compost team, which would visit the residents on their sites for educating them on composting and help them to construct and to take care of their composters.

- Open Windraw System

This system is the most basic composting system. It is not well suited to composting in dense urban areas. It takes more time and space than more intensive systems. Where adequate space is available, this is an inexpensive but effective method for composting.

- Tunnel Technology

Tunnel systems are used for composting biowastes and for sewage sludge processing. Tunnels also have the advantage of potentially releasing fewer odors than other systems. The cost of the system operation may be the potential drawback.

- Anaerobic Digestion

This method replaces the intensive phase of composting and is generally more suitable for homogenous liquid waste, but relatively dry mixed waste can also be successfully anaerobically digested. The end products include methane gas suitable for fuel and a compost-like material. This process reduces the odor emissions significantly.

- Chipping Wood Wastes

Of all the materials in the solid waste stream, woody yard wastes are perhaps the easiest to recycle. A variety of grinding machines will transform brush woody waste into chips, which are immediately marketable or can be easily stored. The markets of the chip products, either as a mulch or as a fuel, are more stable than the markets for many other recyclable materials.

The waste sort results also indicated that there are other waste categories, which represent sufficient potential for recycling and offer opportunities to entrepreneurs to develop recycling businesses.

These waste categories respectively are:

Metals/Appliances/ Junk car

Construction and Demolition

Glass

Plastics

Tires

- Metals/Appliances/ Junk car

Since the metal waste are expected to be one of the major components of the island waste stream in 2000, the historical data from the Anguilla Landfill shows that the share of metals could fluctuate significantly from year to year, but it could present great potential for the recycling business.

Recycling in the non-ferrous sector has an international importance. This extensive range of valuable metals includes copper, aluminum, lead, tin, stainless steel and zinc.

According to the records of Bureau of International Recycling, nearly 40 % of the world requirements of copper are met by recycling, it is clear how important this activity is in reducing dependence on finite reserves of metals in the earth's crust.

Appliances should also be considered in metal recycling. An inherent part of our lives, appliances provide convenience and fulfill essential roles from kitchen to the laundry room. By weight, the typical appliance consists of about 65 % steel. This steel is recyclable. The steel used in appliances, like all steel, is made with a minimum of 25 % recycled steel. For this reason, all appliances contain recycled steel and are recyclable when they have reached the end of their useful lives. The 1999 recycling rate for appliances is 75 %. 18 states have enacted landfill bans for appliances.

Since, the disposal of appliances in the territory reached to a very high level, the regulations on disposal of appliances should be considered and the on or off-island recycling opportunities should be searched for this very valuable steel content products.

Another major component of this category is junk cars. Despite their complex construction, cars are one of today's most recycled commodities. According to the records of Bureau of International Recycling, in 1999, the

steel industry recycled enough steel from old car to produce more than 13 million new automobiles.

The steel used in car bodies is recyclable at the end of its use. The steel and iron components make up nearly 65 % of the average vehicle. They are too valuable to be landfilled, therefore the opportunities for shipping junk cars to off island should be researched as this may create another profitable recycling business opportunity.

- Construction and Demolition

Construction and Demolition waste has also a significant impact on the island general waste stream. This category includes concrete, asphalt, asphalt roofing, aggregate, brick, rubble, drywall and soil, which most of them are currently generated from road construction, and the other construction activities.

This type of waste is also highly recyclable and could be used in the production of concrete, cement, which is locally marketable and also can be used as roadfill.

- Glass

Although, glass only makes up 3% of the general waste stream, is also a significantly recyclable waste type. The use of crushed glass as a replacement for aggregate in the manufacture of asphalt and concrete should b evaluated for the consumption by the local companies. Previous inquiries indicated that there is sufficient asphalt and concrete production locally to consume the glass discarded in the Territory. According to the previous reports in states where glass has been evaluated as a substitute for the aggregate asphalt, up to 15 % of the aggregate could be replaced by glass.

It is unclear whether the amount of glass is encouraging enough to advocate establishment of a glass manufacturing plant to reprocess waste glass into glass products. However, such an activity could be one of the several activities designed to promote an efficient collection and processing recycling foundation. Decorative uses of glass can also offer small-scale glass recycling business opportunity.

- Plastics

Plastics could also be considered for recycling business in the island or collecting and shipping for manufacturing of the products such as carpet, lumber and toys.

- Tires

Although tires have a minimal effect on the general waste stream and the yearly amount of waste tire disposal does not seem to be sufficient for a profitable recyclable business, the total amount of the disposed tires in Anguilla Landfill could represent a one time opportunity for the crumb rubber market. End uses include rubberized asphalt, molded products, mats and playground covers, speed bumps, carpet pads, and soil amendments.

ALBCX received an EPA "Jobs Through Recycling" grant to create the Recycling Economic Development Advocacy (REDA) Project in order to assist those who process, ship, re-use, or re-manufacture materials. This is the biggest step taken in the territory with that goal. The supportive additional projects should also be developed to provide economic growth of the Territory.

Waste combustion (With energy recovery)

Combustion of municipal waste can be viable waste management alternative for many communities. Waste-to-energy (WTE) is the process through which wastes are collected and combusted to create steam and electricity. It is an effective method of solid waste management and landfill volume reduction that many communities now rely on.

Today 121 WTE facilities manage approximately 16 % of all municipal solid waste generated nationwide, according to the Integrated Waste Services Association. These facilities generate enough energy each year to power more than one million homes, roughly the same amount of energy that is supplied by 50 million barrels of oil.

Mass burn facilities (one of three kinds of technology in this field), can burn solid waste without any processing or separation. These facilities can burn solid waste of 200-750 tons per day. That capacity could allow handling of the total amount of daily waste in Anguilla Landfill, approximately 300 tons per day.

Considering the fact that other waste reducing options would decrease the level of waste disposal, waste-to-energy facilities still represents a positive alternative by using them with a lower capacity. Feasibility studies are recommended for determining profitability and suitability to the specific needs of the Territory.

Landfilling

Landfills are used to dispose of the majority of the world's municipal solid waste. Although increased source reduction and recycling will reduce the volumes of waste going to the landfills, they will continue to be essential in the future. The following recommendations have been given to improve the conditions of the Anguilla Landfill.

- Disposal Fee

A disposal fee is an effective method that can affect the waste stream composition in landfills. While tipping fees are imposed on waste haulers to cover the costs of operating landfill operations, they can also be used as an instrument to create long-term policies for reducing certain kind of wastes. The issue of implementing a tipping fee could also be considered for discouraging the disposal of yard waste. Imposing a disposal fee on yard waste would encourage composting. A disposal fee could be implemented on construction/demolition and metal waste that are also major waste categories in the Anguilla Landfill. Before implementing such a fee, priority should be given to the motivation of entrepreneurs on composting and recycling businesses. This would avoid illegal disposal of the waste.

- Sanitary Conditions

The primary purpose of solid waste management processes is remove wastes from living and work areas in ways that protect human health and the environment. New landfill technologies should be utilized to ensure the protection of our present and future environment, such as developing well-designed and well-managed landfills where thick plastic liners are used to seal waste.

- Record Keeping

A computer network should be established between the Anguilla Landfill and the Department of Public Works. The database project designed by Antilitter and Beautification Commission should be activated to insure reliable and proper record-keeping of the landfill. (See Anguilla Landfill Database designed by Antilitter and Beautification Commission)

- Scale Calibration:

The scale in the Anguilla Landfill should be calibrated regularly, and if needed it should be replaced with a new technology scale.

Future sort activities and feasibility studies

Waste audits are very effective way of understanding the waste stream of a territory. They help to prepare a strong base that depends on real records to create long term policies for a successful solid waste management program. Therefore, waste sort projects should be continued and spread throughout the U.S. Virgin Islands. Finally feasibility studies for future businesses should be done in accordance with the results of these activities.

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